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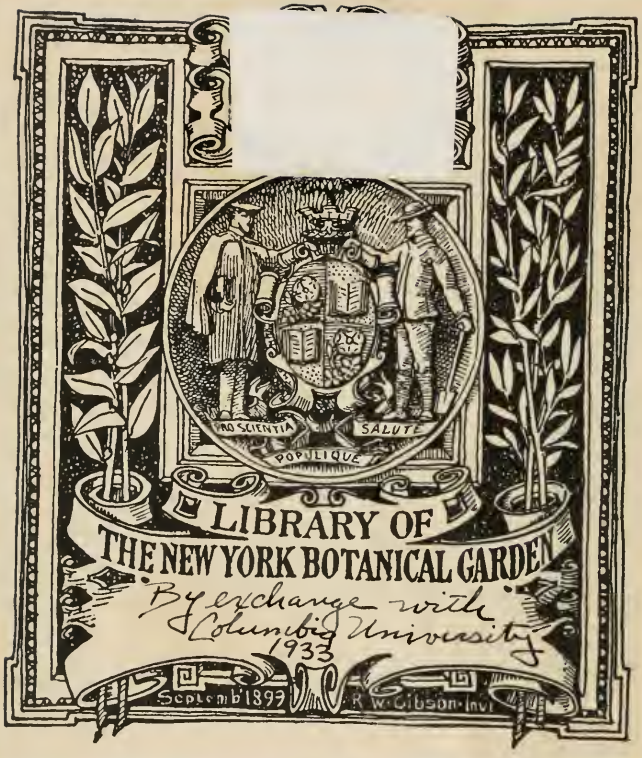
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THE BOTANICAL GAZETTE;

A PAPER

OF

BOTANICAL NOTES.

EDITED BY
JOHN M. AND M. S. COULTER.

Volumes V and VI.

CRAWFORDSVILLE AND LOGANSPORT, INDIANA.

1880—1881.

XB
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vol. 5-6

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COLUMBIA COL
HERBARIUM
NEW YORK

Botanical Gazette.

Vol. V. JANUARY, 1880. No. 1.

EDITORIAL.—With this number begins the fifth volume of the GAZETTE. We do not wish to press its claims too persistently, but at the same time, we do not wish them to be lost sight of, and the volume might as well begin as usual, with both a retrospect and a prospect. When, in November, 1875, the GAZETTE made its first appearance, bearing the already preoccupied name of BULLETIN, having four pages and not a single subscriber or contributor even promised, it was felt to be a hazardous experiment. If the usual methods had been employed, the GAZETTE would never have seen the light of day. In the first place, consultation with botanical friends would probably have frost killed the nascent bud. There would have been objections to the paper and more serious ones to the editor. If it had escaped this ordeal, the attempt to get subscriptions and notes before beginning would have destroyed the last lingering spark of life the frost had left. But those dangers were avoided by acting in no such prudent way, but by starting as if all botanists were encouraging and there was a large subscription list pledged. The end of it was that the GAZETTE was not a paying investment for the first year, and not much better the second. The third and fourth years have seen a rapid advance, and the time has come at last when it seems that the GAZETTE is really able to completely pay its way. At the same time the printed matter has been quadrupled and the subscription kept at the original price.

There has been another favorable change. The first volume or two were mainly editorial, and as neither of the editors had had a particularly large botanical experience, there was sometimes a good deal of space devoted to a very little matter. Now the editor need not write at all with the object of supplying the call for "copy," but only for the purpose of stirring up friends whose zeal begins to flag, and of convincing strangers that they had better be strangers no longer. In view of the fact, then, that in the struggle for existence the GAZETTE has seemed to be the fittest to survive, while others have perished, we would urge that botanists take vigorous hold and by means of subscriptions, advertisements and contributions, make this volume unexampled for its rapid advance.

CATALPA SPECIOSA, Warder.—A middle sized tree with grayish-brown, much cracked or furrowed, at last slightly flaky bark and light, yellowish gray wood; leaves large, truncated or more or less cordate at base, slenderly acuminate, soft downy on the under side, inodorous; flowers in large and loose panicles; tube of the corolla conical, longer than wide, its lower part scarcely protracted; upper lip before its expansion longer than the other lobes and enveloping them, lower lobe

bilobed, inside of corolla slightly marked at the throat with red brown lines, and with two yellow bands at the commisures of the lowest with the lateral lobes; stamens and style as long as the tube; pod terete, strongly furrowed; wings of seed about as long as the seed itself, and rounded at the ends and split into a broad coma.

Common in the low, rich, sometimes overflown woodlands near the mouth of the Ohio, along the lower course of the river and its confluents, and in the adjoining lowlands of the Mississippi; in the States of Illinois, Indiana, Kentucky, Tennessee, Missouri and Arkansas; according to Michaux abounding near the borders of all the rivers which empty into the Mississippi further south; whether the localities, cited by him, of West Florida produce this or the Eastern species, is at present unknown.—Flowers in May.—This tree has quite an interesting and instructive history. It was already known to Michaux and to many botanists and settlers in those regions; even the aboriginal Shawnees appreciated it and the French settlers along the Wabash named it for them the Shawnee wood (Bois Chavanon) and prized the indestructable quality of the timber, but the botanists, even the subtle Rafinesque, who roamed over those very regions, seem to have taken it for granted that it was not distinct from the Southeastern *Catalpa bignonioides*. To me the fact that these trees, then not rarely cultivated in St. Louis,* produced their larger and more showy flowers some 10 or 15 days earlier than the Eastern or common kind, was well known as early as 1842 and their blossoming has since been annually recorded in my notes on the advance of vegetation, but I had not the sagacity or curiosity to further investigate the tree. It was reserved to *Dr. J. A. Warder*, of Cincinnati, to draw public attention to it. He was struck with its beauty in the streets of Dayton, Ohio, where a few stragglers were cultivated, and described it cursorily in his Journal, the Western Horticultural Review, Vol. II, page 533, without deciding whether a distinct species or a variety, and without assigning a name to it. It was soon named, however, privately as it seems, by him and his friends *Catalpa speciosa* and was propogated as a more ornamental form. Thirteen years later I find in the catalogue of J. C. Teas' nursery, Baysville, Indiana, for 1866, *Catalpa speciosa* offered, the 100 one year old seedlings for $1.50. But only within the last few years the beauty and importance of the tree has made a greater impression on the public mind, principally through the exertions of Dr. Warder himself. Mr. E. E. Barney, of Dayton, and Mr. R. Douglas, of Waukegan, Ill. The latter was so much struck with the future importance of this species that in the Autumn of 1878 he collected on the lower Ohio 400 pounds of its seed for his own nursery and for distribution to all parts of the world.

Catalpa speciosa replaces *C. bignonioides* entirely in the Mississippi valley. It is readily distinguished from it by its taller and straighter growth, its darker, thicker (½–1 inch thick), rougher and scarcely exfoliating bark (in the older species it is light gray, constantly peeling off and therefore not more than 2 or 3 lines thick); its softly downy,

*It seems singular, that the common Eastern species has in our streets almost completely supplanted the much handsomer native.

slenderly acuminate and inodorous leaves (those of *bignonioides* have a disagreeable, almost fetid odor when touched), marked with similar glands in the axils of the principal veins of the under side; by its much less crowded panicle and by its much larger flower, fruit and seed The flowers I found 2 inches in the vertical and a little more in the transverse diameter; in the other they have 1⅔ inches in each diameter; the lower lobe is deeply notched or bilobed in *speciosa*, entire in *bignonioides;* the tube in the former is conical and 10 lines, in the latter campanulate and about 7 lines long, in the first slightly oblique, in the other very much so, the upper part being a great deal shorter than the lower one, so that the anthers and stigma * become uncovered; the markings in the flower of the old species are much more crowded and conspicuous, so as to give the whole flower a dingy appearance, while ours looks almost white. The upper lip of the corolla before expansion extends beyond the other lobes and covers them like a hood in the Western species, while in the Eastern it is much shorter than the others and covers them only very partially. The pods of our species are 8–20 inches long, 17–20 lines in circumference, dark brown and strongly grooved, when dry, the placental dissepiment very thick; in the Eastern species the pod is nearly the same length, but only 9–12 lines in circumference, its grooves very slight, its color pale and dissepiment flat. In both species the pod is perfectly terete before the valves separate, after that the valves of ours remain more or less semiterete, while the much thinner ones of the other flatten out, so that they *seem* to indicate a compressed pod. The elongated seeds winged at both ends, are of about equal length in both species, but in *speciosa* they are much wider (3½–4 times) and the wings have more or less rounded ends which terminate in a broad band of rather short hair; in *bignonioides* the seeds are only 2½–3 lines wide, with pointed wings and their tips terminating in a long, pencil shaped tuft of hair.

Our tree is larger, of straighter growth and being a native of a more Northern latitude is hardier than the Southeastern species; the wood of both is extremely durable, perhaps as much so as that of our red cedar, and has the advantage over it of a much more rapid growth and of possessing only a very thin layer (2 or 3 annual rings) of destructible sap wood. But of these qualities and of its adaptability to many important uses others, and especially Mr. Barney in a recent pamphlet, have given a full account It is already extensively planted in our Western prairie States and especially along railroads, for which it is expected to furnish the much needed timber in a comparatively short time. —G. ENGELMANN, *St. Louis, January 1, 1880.*

TENNESSEE PLANTS.—Along with specimens we receive from time to time valuable notes from our esteemed correspondent, Dr. Gottin-

*I may here remark that *Catalpa*, probably like all its allies, is proterandrous, the anthers open in the morning and the lobes of the stigma separates and become glutinous toward evening, the upper lobe remaining erect, the lower turning down close upon the style. I have not ascertained how they are impregnated as at that time the anthers are effete, and by the following morning the lobes of the stigma are again closed.

ger, of Nashville, Tenn. A few of them may here be put on record. *Forestiera ligustrina* does not (like *F. acuminata*) blossom in early spring from axils of the preceding year. On the cedar barrens near Nashville, where it abounds, the fragrant flowers develop about the middle of August from the axils of the leaves of that year; and the fruit ripens at the end of September. That of *F. acuminata*, which blossoms very early, is ripe before the end of May. *Tragia macrocarpa*.—Both surfaces of the leaves bear stinging hairs *Phlox Stellaria*.—This neat and rare species is found at Lavergne, seventeen miles from Nashville, in cedar barrens, growing in beds of sphagnum and other mosses, in moist places. *Thermopsis Caroliniana*, a most rare species, has been found by Dr. Gottinger on the Harpeth hills, near Nashville.—A. GRAY.

LITTORELLA AND SCHÍZÆA IN NOVA SCOTIA.—It is singular how a long-overlooked plant, once detected, is then promptly found again and again. Following upon Mr Pringle's announcement of the second discovery of *Littorella lacustris* (at the northern end of Lake Champlain), I have now to announce that Miss Elizabeth G. Knight, of the New York Normal College, found it in August last, growing abundantly between the stones on the shores of Grand Lake, Nova Scotia, twenty-three miles from Halifax.

Botanists will be equally interested to know that she also detected, among the rhizomes of *Osmunda regalis*, near the lake shore, the rare *Schizæa pusilla*. La Pylaie's specimens in his herbarium at Paris, collected in Newfoundland about sixty years ago (which I have seen), had accredited this plant to New Foundland; but I believe no one has since found it out of New Jersey until this happy discovery by Miss Knight in an adjacent portion of British America. —A. GRAY.

THE COEFFICIENT OF CONTRACTION.—My attention was lately drawn to a remarkable case of the difference in length, produced by unequal "seasoning," in the two sides of an oak post. The post referred to is about four inches square; one end is sunk in the ground and the other projects ten and one half feet above the surface. When placed in position some time ago it was straight and perpendicular; at the present time it leans toward the south, deviating a little over 1 foot from the perpendicular. The post was "set with the compass," and it is interesting to note that a north and south line lies in the plane of the curve.

Experiments have given us the coefficients of expansion in different metals. Why may we not have experiments to determine the coefficients of contraction in different woods, i. e., to determine the fractional decrease in length produced in rods of "green" wood, say 1 meter long and 2 cm. square, by the application of a steady and absolutey dry heat for a given length of time? The knowledge would be of no practical importance perhaps, but it might bring out unsuspected correlation between looseness of tissue and amount of contraction.—C. R. BARNES, *La Fayette, Ind.*

NOTES ON FUNGI.—The great drought which extended throughout Maryland in June and July, 1879, was discouraging to the collector of Fungi. Very few Agarics appeared, and the Boleti, with the exception of a few stunted forms, were not represented. Even in eastern Maryland, where the atmosphere is humid, the land low—woods often in swamps—plains intersected by narrow streams and broad rivers—there was a like scarcity of plants.

For the past four years certain species of fungi have been plentiful in nearly all woods within the distance of thirty miles from Baltimore. In June and July, 1877, likewise in 1878, the woods near Lutherville, Baltimore county, was adorned with beautiful forms and glowing colors. This profusion continued at intervals until September, a few coming as late as November.

The first and only perfect plant I collected in June, 1879, was *A.* (*Coprinus*) *micaceus*, Fr. It had chosen a low situation on a lawn that was kept constantly watered with a hose. In this way it obtained sufficient moisture to reach perfection. The pileus was ovate, pale ochraceous or cinereous, 1½–2 inches broad; two were covered with micaceous granules, the rest were smooth; margin deeply striate, nearly plicate; lamellæ, at first white, turning to black; deliquescent; stipe hollow, white, silky; spores .0003 x .00035 of an inch long, .0003 of an inch broad; black; plant cæspitose. On the day that I found this Agaric, I asked a laboring man if he had seen any "Frog stools" in that section? He looked at me earnestly, repeating: "Frog stools! Why, they isn't come up yet. What does anybody want with them pison things? You'll pison yourself to death!" A few days after this I met with the same man, and was greeted with the query: "Found any frog stools, yet?" When I replied in the negative, he instantly said: "An' it's a blessed thing you can't find 'em! Better let frog stools alone! That's my advice to everybody." When turning to walk off, one of my companions heard him remark in an under tone: "Poor thing; crazy, certain sure. Clean gone mad!"

During the great drought in July I met with *Boletus strobilaceus*, Scop., growing solitary upon the summit of a high embankment. Considering the parched and slippery grass that one had to pass over, it looked like a break neck excursion to attempt to reach it; but with the aid of two stout sticks I succeeded in gaining the eminence. The plant was perfect in all its parts, with a pileus 2 inches broad. The wonder was how a spore could germinate in soil that was apparently without moisture; but so it was. In very wet seasons this fungus often attains 10 inches across pileus. In the latter part of July, *A.* (*Lentinus*) *lepideus*, Fr., appeared in profusion on an old stump in Druid Hill Park, near Baltimore. The stipes were scaly, rooting below and variously branched; each branch bore a perfect pileus 2–4 inches broad, mostly convex, white, covered with small, pale brown scales; lamellæ white, decurrent; spores .00026 x .0003 of an inch in diameter. *A.* (*Amanita*) *strobiliformis*, Fr., appeared in Druid Hill Park about the same time. This is a majestic plant with a pileus 8–9 inches broad, dirty white cinerous and even ochraceous, covered with persistent warts not unlike the scales on a small pine cone; lamellæ

white to cream color; stipe 6–7 inches high, 1–2 inches thick, floccoso-squamose, bulbous, rooting, bulbs large and conical, extending 6–8 inches below the surface, ring large, lacerated, volva short, encircling the bulb like a frill, lacerated at margin; odor delightful, somewhat resembling that of our edible *A. campetris*, but more powerful; the aroma from the bulb is even greater than from the pileus; spores .00057 x .00035 inch, plant gregarious; open places in woods. One more plant, *Zylaria polymorpha*, Grev., which grew on an old stump at Druid Hill Park, completed the collection made in June and July, 1879.

The heavy rains of August brought Agarics and Boleti in both sections of the State, but at no time were they so plentiful as in past years, neither did they continue later than the first week in September, in consequence of a second drought. Possibly, if one had explored eastern Maryland extensively, new and different forms might have been discovered, but with the exception of *Panus strigosus*, B. & C., found there only, the flora of the two sections was precisely the same, except that the plants from eastern Maryland were generally larger. *A.* (*Amanita*) *muscarius*, L., was remarkably beautiful, pileus 8–9 inches broad, canary yellow, covered with pale ochraceous warts; margin striate; lamellæ white; stipe 6–7 inches thick, bulbous; volva broken up skirting the bulb in large, heavy flakes; ring large; fugaceous; spores .00026 x .00032 inch. In western Maryland this plant was scarce, dwarfed in size, and not to be found in woods it occupied in 1878. The pileus varies in color from ochraceous brown to canary yellow; the spores were also slightly smaller, .00018 x .00032 inch. *A.* (*Amanita*) *rubescens*, Pers., also a very handsome plant, had a pileus 8 inches broad, dark red to sienna red, covered with brown warts, margin striate; lamellæ white; stipe 7–8 inches high, bulbous, almost fringed with red scales; spores .00022 x .00032 inch. In western Maryland the stipes were without one exception clothed with red scales, not marked or streaked with red as heretofore; pileus 4–5 inches across; stipe 3-4 inches high; spores .00018 x .00032 inch. The flesh in all turned red when cut or bruised, but this is not constant; very often the flesh is white and unchanging. *A.* (*Amanita*) *vaginatus*, Bull., from eastern Maryland, was unusually large and beautiful; the pileus measured 6–7 inches across, more or less studded with scales at disk, not persistent, mouse gray, margin deeply and beautifully striate; lamellæ white, striped with a cottony substance; stipe 6–7 inches high, sericeo squamulose, hollow or stuffed, volva sheath like; spores .00032 x .00040 inch. The easy splitting of the stipe longitudinally seems to be a constant character in the fungus. In western Maryland, *A. vaginatus* rarely measures more than 3–5 inches across pileus, variable in color, mouse gray or various shades of slate color, sometimes white; lamellæ with or without the cottony stuffing; pileus with or without scales. *A.* (*Amanita*) *nitidus* Fr., was large in both sections of the State, with a pileus 6–8 inches broad, white with a tinge of umber, deepened at disk, covered with pale cinereous warts; margin not deeply striate; lamellæ white, stipe 4–5 inches high, solid, squamose, attenuated upwards, bulbous at base, ring fugaceous;

spores .00024 x .00032 inch. *A.* (*Amanita*) *solitarius*, Bull., was another fine looking Agaric; the pileus measured 6–7 inches across, covered with warts more or less erect at disk and tinged with ochre; lamellæ white or cream color; stipe solid, unequal, squamose, and even imbricated; bulb very large, rooting below, ring torn. This fungus has always appeared solitary until last summer, when I found two growing very near each other. The *Lactarii* were variable in size. *Lactarius insulcus*, Fr., pileus 4–7 inches broad, margin sometimes distinctly striate, then faintly striate, again without striæ; at times faintly zoned, then plainly zoned, then zoneless; color various shades of yellow, often buff color; lamellæ concolorous; stipe stuffed or hollow, pale shade of yellow; spores .00032 of an inch in diameter, milk white and plentiful; taste extremely acrid. The stipes of several of these plants were lacunose. The *Russulæ* from eastern Maryland were generally large. *R. virescens*, Fr., came with a pileus as large as an ordinary breakfast plate, metallic green, varying in depth of color, more or less covered with patches or scales from green to ochraceous green and even yellow; margin striate all the way round, then only at intervals; lamellæ white, brittle, more or less forked; stipe equal, short, stuffed, white; spores .00028 x .0003 of an inch in diameter; taste pleasant. This plant appears in western Maryland with the same variations, but smaller. *R. emetica*, Fr., measured 8 inches across pileus, variously shaded from bright red to sage color; lamellæ white; stipe white stained with red; spores 00036 of an inch in diameter; taste acrid. *R. alutacea*, Fr., was about the same size, with a red pileus; buff colored lamellæ and half colored spores; very mild and pleasant to taste. *R. rubra*, Fr., a remarkably handsome plant, the ornament of the woods wherever it grows, with its beautiful, glossy red or deep pink pileus, white lamellæ, white or pinkish stipe, and acrid taste, was large and plentiful.

Boletus luridus, Schæff, from both sections of the State, came glowing with color. Pileus 5–6 inches broad, bright red or scarlet shaded into bright yellow at margin, excessively viscid, shining as if varnished, convex or expanded; pores convex, at times adnexed, again nearly free, again free, dark brownish red, bright yellow with red around the orifices, then bright orange color; stipes red with brown reticulations, again reticulated with carmine. Heretofore the pileus of this fungus has been slightly tomentose, dark reddish brown, pinkish, and brick-red; pores free, yellow, with red around the orifices; spores .0006 x .00038 inch, dark olivaceous green. The flesh of this plant, when eaten into by insects, does not change to blue. I have found this to be the rule without one exception. In eastern Maryland I collected a curious *Boletus*, the name of which I do not yet know. Two plants seem undecided whether to remain Boleti or to become Agarics One was decidedly lamellated on one side nearly to the margin, the other lamellated only at intervals. The same plant appeared about the same time in western Maryland, but lamellated only as the pores reached the stipe. Two specimens of *Polyporus applanatus*, Fr., I found growing in short grass about ten yards from an oak tree. The pileus of one plant measured 4 the other 5 inches across.

There was evidently a struggle to adapt themselves to their new habitat. There were neither roots or dead wood for them to adhere to, and I concluded that some severe storm had separated them from the tree and placed them in their new position.

The above plants comprise only a few out of the large number I collected in 1879. Many that appeared in profusion during the Summer and Autumn of 1878, were not with us in 1879. Perhaps the most conspicuous amongst the missing for their singular beauty as well as for their offensive odor were *Phallus duplicatus*, Bosc., and *Phallus impudicus*, L. I found *Phallus duplicatus*, in the early part of June. Three plants in three different periods of growth were close beside each other in an open place in the woods. The first form of this fungus is that of a puff ball, containing a tremulous mass of gelatine. Within this is *P. duplicatus*, with its rudimentary pileus and stipe preparing to burst through the volva. In the second period of growth it escapes the volva sufficiently to show the pileus, together with a portion of the stipe around which hangs a white reticulated frill looking like a beautiful lace drapery; pileus 6-7 inches across, campanulate, lacunose and distinctly marked with variously formed reticulations; a portion of gelatine clings to it, which, from the action of air and light often turns amber color, giving a showy, transparent appearance. In the fully developed plant the external surface of the pileus rapidly passes into mucilage and drips away in deliquescent drops of a dark olivaceous green, almost black. The perforated apex is firmly attached to the stalk and bordered with a delicate edge of white or cream color. Beneath the pileus the stalk is conical and covered with a reticulated drapery, which adheres for the space of one inch, when it flows off and hangs down loosely like a white lace frill an inch or so below the pileus. There is attached to the apex a lengthened drop of gelatine, two inches long, which hangs within the cavity of the stalk and seems to furnish its internal lining with mucilage. The pileus is lined with a smooth white skin slightly viscid. The stalk is 10 inches high, 1–2 inches thick, white, looking like carved ivory, hollow, with a white, smooth, glossy, internal lining, externally covered with small and variously shaped cavities which extend to the internal lining, but do not penetrate it, forming a substance somewhat like the fine tissues in bone, cutting hard and brittle; exceedingly delicate at the base, and but for the volva which remains upright with its mass of gelatine, it would have nothing to support it. The volva is universal and composed of a strong, rough looking, tough skin, whose sole duty seems protection; within it, and extending to more than half its height, there is a partition or dividing wall of tough, thick white skin, this keeps the gelatine in place separating it from the stalk and holding it fast between the two walls.

Strange to say I drove six miles in a public conveyance with three of these plants closely covered in a basket, without hearing a remark upon the abominable odor. By the time I reached my place of destination the smell had increased to such an extent that the flies nearly devoured me, in their eagerness to get at the fungus. Worse than all there was an outcry through the house, one enquiring of the

other what the loathsome smell could be, and where it came from. Each moment was filled with anxiety, lest my precious fungus, for which I had already endured so much, might be seized and carried off before I finished dissecting it. The pileus was crowded with beetles, and judging from the eaten portion they must have relished it greatly for they had taken a hearty lunch. *Phallus impudicus*, which I found shortly afterward was equally offensive and attractive to flies and beetles.

While it is interesting to observe the variations in the color, size and configurations of certain species of fungi, it is equally so to note their absence from one locality, for an indefinite time, and perhaps their appearance in another. One is led to suspect that the spores either hibernate or are carried by the winds to far off sections like the seeds of some phænogamous plants; or there may be in some seasons an absence in certain qualities in soil and atmosphere requisite for their germination. In sections where no changes have been made, such as draining the soil, cleaning out woods, or cutting down trees, we are constantly missing plants for a period of one or more years as the following notes will show:

In 1877, *Lactarius volmum*, Fr., was plentiful from June to September, but very slender in form. In 1878, not so plentiful, but very large. In 1879, it left its old haunts and other plants took its place, though in some instances its place was unoccupied. *A.* (*Tricholoma*) *virescens*, Pk., was plentiful in 1877, but has never appeared since. *Boletus ornatipes*, Pk., as well as many other plants that one could not go amiss for in 1877, were rare in 1878, none in 1879. For three successive years I found *A. vaginatus*, in one spot, on or about the fifteenth of July; in 1878 it was missing, but appeared plentifully in a distant woods. *A. laccatus*, Scop., was scarce in 1877, mostly to be found on dead leaves and sticks. In 1878 it carpeted the woods in some places three yards in diameter; in 1879, not one was to be found in the same locality; it took a freak to visit a woods ten miles distant, and after having been small and unpretending in appearance it assumed the most beautiful and fantastic shapes, as well as the brightest colors; pileus 4–5 inches across, convex, umbilicate or deeply infundibuliform; lamellæ often bright reddish purple, with a deep flesh color or bright sienna-red pileus. *Fistulina hepatica*, Fr., has been rare for several years past, but last August old oak stumps as well as the projecting roots of oak trees, were crowded with it. At first sight it presented the most curious appearance, looking like large pieces of raw flesh or liver scattered about on the grass. It has a delightful acid taste. *Morchella esculenta*, Pers., and *Helvella crispa*, Fr., so plentiful in 1877, has not been seen since. That beautiful little plant *Cyathus vernicosus*, DC., which abounded in nearly all gardens in 1878, was absent in 1879. During some seasons when other species are so plentiful the *Trichogasters* are poorly represented. In 1876, *Geaster fimbriatus*, Fr., was abundant, but I have not found one plant since. In 1877, *Lycoperdon gemmatum*, Fr., crowded the woods in almost every section; one or two imperfect forms appeared in 1878,

none in 1879. *Lycoperdon cyathiforme*, Bosc., numerous and very large in 1877, has not been with us since. *Scleroderma vulgare*, Fr., plentiful in 1877, two imperfect forms in 1878, none in 1879.—M. E. BANNING.

NOTES ON SOME INTRODUCED PLANTS IN DALLAS COUNTY, TEXAS.—These are notes on most of the naturalized plants in this county.

Adonis autumnalis, L., was imported by the French colonists in 1855, and appears in many fields and along the roads.

Nasturtium officinale, R. Br., was first introduced about twenty years ago, but became common only within four or five years.

Capsella Bursa-pastoris, Mœnch, was seen for the first time in 1865, but has become quite a common weed.

Viola tricolor, L. var *arvensis*, Ging., I am satisfied, is native. I have met it in large patches in remote woods and prairies, sometimes very far from settlements. The true *V. tricolor* has been naturalized in gardens and seems to be keeping its characters very constant. I believe the two may be considered good species.

Portulaca oleracea, L., is certainly native, although it has been considered by most of the botanists as an introduced species. It infests all cultivated fields. You may go 100 miles from civilization, break the prairie, and the second summer will be sure to see it covering your field This year in traveling on the northwestern frontier, far from any settlement, I have met it growing in prairie dogs' villages, in company with the *P. pilosa* and *P. lanceolata*, both considered native species.

Tribulus maximus, L., was introduced about 1860.

Abutilon Avicennæ, Gœrt., made its appearance about the same time.

Conia occidentalis, L., belongs to the same period.

Anthemis Cotula, L., dates from 1875, and since has been very common in the city of Dallas.

Impomea purpurea and *I hederacea* are common in some fields, but I have not the date of their introduction.

Datura Tatula, L., is very common and was naturalized long ago.

Martynia proboscidea, Glox, is sparingly naturalized, but seems spontaneous in the West

Verbena officinalis, L., is certainly native. It grows in all the sandy woods and wild praries. The roots are *positively* perennial, which does not agree with the description in the Synoptical Flora of Dr. Gray.

Marrubium vulgare, L., appears in the neighborhood of cattle and sheep lots after a few years of settlement.

Boerhaavia viscosa, Lag., was first seen in 1876; *B. stricta*, in 1879.

Rumex obtusifolia, L., seems perfectly at home in all damp places.

Chenopodium hybridum, *C. murale*, *C. ambrosioides* and *C. anthelminticum*, are more or less common, the last seeming perfectly indigenous.—J. REVERCHON.

DIMORPHO-DICHOGAMY IN JUGLANS AND CARYA.—Referring to a note by Mr. Pringle, in No. 12, Vol. 4, it may be interesting to note that in the grounds of Dr. Dunton, in Germantown, there is a very large *Carya olivæformis*, supposed to have been introduced to the garden through the agency of Mathias Kin, in the early part of the present century, which bears nuts very freely every year, as I believe. The nearest tree that I know of its kind is at the Bartram garden, some fifteen miles away. Single specimens of *Juglans cinerea* are not uncommon in Germantown gardens, with other trees a quarter or a half mile away. Groups of them are not uncommon in the Wissahickon two or three miles away from the gardens. These trees generally bear. Some years along the whole line of the Wissahickon there is not a nut to be found. When there are any at all, they are found on every tree.—THOMAS MEEHAN.

MR. M. S. JONES' COLORADO NOTES.—*Malvastrum coccineum.*—Without questioning the accuracy of Mr. Jones' determination, I yet feel moved to "suspend judgment" on the noxious qualities of this species. It seems so incredible that a malvaceous plant should have this fearfully toxic property, that it will be safer to believe the stock men have not sent the real culprit. "Twelve hundred sheep dying in four hours," does not strike those acquainted with the vegetation about Pueblo, and the nature of the ovine constitution, as being particularly careful records of the facts.

Neillia Torreyi.—In addition to the pubescent ovaries, it may be noted that the calyx and pedicels have the same character,—the calyx indeed often quite woolly. This is particularly the case with specimens I collected in 1871, in what is now Englemann's canon. This thick pubescence seems to follow all the forms found in Colorado, and is a good distinguishing mark from the Eastern species, *N. oppulifolia.* Beside there is another good character not noted by Mr. Watson, in the calyx, which has its sepals obtuse, while in the Eastern species they are apiculate as the carpels are. Botanists speak of the *N. Torreyi* as a "small species with small leaves and flowers," but this is only true as regards the altitude at which it is found. I have some specimens gathered in 1873, exact locality not noted, in which the whole plant was not probably over a foot high, with the leaves smaller than the most stunted *Ribes rotundifolium*, which in that condition, they much resemble. Some from the high hills at the entrance to South Park, through Golden Gate, gathered in 1871, were from plants two to three feet high,—while the specimens gathered near the mouth of Englemann canon, in 1871, were from bushes, as large as the average of those we see of *N. opulifolia* in the East.

Aquilegia chrysantha.—Mr. Jones says he has seen *Aquilegia chrysantha* "occasionally," with "both colors of flowers on the same plant." By "both colors" I infer he meant the blue of *A. coerulea* and the yellow of *A. chrysantha.* This would be a valuable fact if there be no mistake in the plant in Mr. Jones' mind. As he refers to finding the plant near "Colorado Springs," I may fairly suggest some

mistake. What is now Colorado Springs was once my camping grounds when it was a "wild waste," and if any where I think I should have found *A. chrysantha* there. I never knew of any one finding it there. Though found in southern Colorado, I believe, I have never met with it myself in the State nor even in Utah, where it is probably more at home. There seems to be an error also, in the reference to "Rothrock in Wheeler's Survey." Instead of making "similar observations," he says they are "*always yellow*," italicising the words. From my observations of *A. chrysantha*, under culture, which have been extensive, I should imagine there was as much distinction between the two species named, as between any other species, for, in the whole genus the "evolutionary links" have not been lost in many instances. *Smilax herbacea*, was collected by Isaac C. Martindale and party, in Queen Canon, in 1878; as also was the interesting variety of *Ampelopsis quinquefolia*. The valuable observations on the flowers which Mr. Jones made, were, however, not noted, the plant being then only in fruit. See also Porter's *Fl. Col.*

Mr. J. will, I trust, pardon these few criticisms, as they are offered solely in the interest of Botanical Science. —THOMAS MEEHAN.

AN EXCHANGE FRAUD.—For the benefit of others engaged in collecting and exchanging I would like to expose one *Willie F. Wamble*, of Raleigh, N. C., whose plan is to get plants sent him for which the sender gets only promises in return. Botanists who have no duplicates to throw away, will save them by steering clear of him. Not only has he defrauded me of a lot of ferns, but I have it from good authority in Raleigh, N. C. that he is not reliable —R. H. WILDBERGER, *Prof. Nat. Sciences, Ky. Mil. Inst., Farmdale, Ky.*

BOTANY TO THE AID OF GEOLOGY.—"The little facts of science, seemingly trifling, are often of great value in deciding greater questions or, at least, ones deemed of more importance by the human race. On Kerguelen's Island, a tract 4,000 miles west of Cape Horn, our common fern (*Polypodium vulgare*) is found. Other plants common to America are also found there. It is considered out of the question that they had their original home center there, and it is deemed highly improbable that they could have been carried there by any agency now existing. The only suggestion deemed within probability is that there must in the past have been a land connection between these points, now four thousand miles apart. This was Dr. Hooker's view, when he visited the Island and noted these plants many years ago. Geographers connected with the 'Challenger" expedition have now come to the same conclusion with the botanist, from an entirely different line of reasoning. There are several plants on the Island found no where else. One of these (the *Pringlea antiscorbutica*) is not only special to the Island, but it is distinct from any known coniferous plant, in having no powdery pollen and no petals. And these facts are taken to indicate that a long connecting line has been swept away "—*Independent.*

COLUMBIA COLLEGE HERBARIUM, NEW YORK

Botanical Gazette.

Vol. V FEBRUARY, 1880. No. 2.

EDITORIAL.—A new school of botanists is rapidly gaining ground in this country and we are glad to see it. While the country was new and its flora but little known it was very natural for systematic botany to be in the ascendency. It is a very attractive thing to most men to discover new species, but when the chance for such discovery becomes much lessened there is a turning to the inexhaustible field of physiological botany. Systematists are necessary, but a great number of them is not an essential thing and it is even better to have but a few entitled to rank as authorities in systematic work. But in studying the life histories of plants or their anatomical structure we can not have too many careful observers. This, at the present day, seems to be the most promising field and one botanist after another is coming to appreciate it. As microscopes are becoming cheaper and hence more common the workers in the histology of plants are becoming more numerous and it is to such that the GAZETTE would now address itself. It will be noticed that the notes published heretofore would largely come under the head of systematic botany, and it is our intention to continue to give large space to this subject, but we would like to take a stand in this new school and call for notes from its workers. Dr. Rothrock's paper on "Staining of Vegetable Tissues" was a start in the right direction and the eagerness with which such papers are now read is shown by the fact that that issue of the GAZETTE was entirely exhausted in filling orders. We expect to receive many notes pertaining to this branch of our science and if botanists who are interested in it will but come forward the GAZETTE will willingly open its pages to them. Let not only the results of study with the microscope be noted, but observations on the habits of plants, such as their fertilization, movements, absorption and evaporation of moisture, and the many other subjects which are now attracting so much attention. Let there not only be a record of such observations but expressions of opinion as to the best method of teaching how pupils can be made observers, and how far this can be profitably carried. Such topics would open up a new and large field to the GAZETTE and one that would be of interest to all botanists. That short notes upon the teaching of botany would be read with interest goes with the saying, when it is understood that nearly every other man upon our subscription list is a Professor of some kind or other, and that there is no college in the United States, where botany has any sort of prominence, where the GAZETTE is not taken.

VIOLA TRICOLOR, L. VAR. ARVENSIS, DC.—The plant of the United States, so named by Torrey and Gray, is *V. tenella* of Muhl-

enberg (Cat. 1813) and *V. bicolor* of Pursh (Fl. 1814), who evidently regarded it as native and for that reason, perhaps, a distinct species. Even if further comparison with European specimens should prove the determination of Torrey and Gray correct, its claims to a place in our indigenous flora seem to me very strong. In Pennsylvania it is widely diffused, but rare, yet abundant wherever found. It occurs in grassy meadows and on rocky slopes, remote from dwellings and never in cultivated grounds. Its entire behavior is that of a native, and hence unlike that of *V. tricolor* of the gardens, which, though it comes up from self-sown seeds, soon disappears, when not reinforced by fresh plantings, and shows no disposition to spread beyond culture. Mr. Reverchon. in the last number of the GAZETTE. reports it from Dallas county, Texas, and says: "I am satisfied it is native. I have met it in large patches in remote woods and prairies, sometimes *very far* from settlements" To this I may add the fact that it has also been collected in Colorado by Mr. Wm. A. Henry, who thus wrote me Aug. 29, 1876–"I send you more of the violet. It grows on a warm, dry slope at the mouth of Boulder Canon, in a rather inaccessible place. I have seen a few stalks further up the canon. It blooms very early, along with *Leucocrinum montanum*, so that it has probably escaped the notice of other collectors. I gathered it three years before in the same place. It *could* have been introduced, but I greatly doubt that seeds of recent introduction could have reached the spot where I found these plants."

I may here mention another addition to the flora of Colorado. Aubrey H. Smith, Esq., has kindly given me specimens of *Goodyera repens*, R. Br., collected by him on Pike's Peak, Aug. 1878.—THOS. C. PORTER.

LEPIDIUM CAMPESTRE, LINN.—Last September as I was just coming out of the hay fever, a farmer brought me a package of what he said was now becoming a troublesome weed. I instinctively smelled of the plant and brought back some decided symptoms of my malady. The weed proved to be *L. campestre*. As this has hitherto been a rare plant, it is of interest to know that with us it is no longer so. But this crucifer has struggled hard to attain its acclimatization. An adventurer from Europe, it came, as I believe, from Great Britain, where it was accustomed to a mild and humid climate, hence, though a great seed bearer, ere it could become prolific of individuals it had to struggle through several generations of years in a climate involving extremes so opposite to the conditions of its native land.—S. LOCKWOOD, *Freehold, N. Jersey*.

ZOSTERA MARINA, L.—A. Engler, in a recent number of the *Botanische Zeitung*, has published some interesting observations concerning the "Eel grass," so common in the bays of our own coast. His observations relate chiefly to fertilization and growth. The following is an abstract of his paper from a late number of *Nature*.

At first the thread like stigma lies on the neighboring anther lobes,

mostly those of the two different anthers; next the style elevates itself, and so the stigma comes out of the narrow slit in the sheath, and receives pollen from some of the older spadices.

After fertilization the thread like stigmas disappear and at the same moment will be found clusters of as yet unopened anthers around the stigmaless gynœcia, these now having fertilized ovules. This was probably the stage observed by Hofmeister when he described the fertilization as taking place inside the unopened inflorescence. Certainly the anther lobes are not at this stage always emptied of their contents, and certainly when the emptying takes place the gynœcia are often beyond the power of being fertilized.

The condition of the buds also engaged Engler's attention, because the sympodial bud system appeared similar to many Araceæ. The main shoot develops sterile buds from the axil of the nodal scale and then after developing 4 to 6 internodes in the mud grows upward, giving rise to leaves frequently a metre long but never in the same year is inflorescence observed. In the axils of the lower leaves fertile buds are developed which lie alternately to right and left of the main axis. These grow for a great while along with the main axis, the axis of growth thus presenting a flattened cone-shaped form with two furrows superimposed on a cylindrical axis.—C. R. B.

ASPLENIUM BRADLEYI.—During the fall of 1876 while collecting ferns on White River, in northwestern Arkansas, a few specimens of *Asplenium Bradleyi* were found. Since then, by searching closely several localities have been discovered, which have yielded some fine specimens. The species seems to grow upon sandstone, exclusively, as it has not been found on any other formation, and to require situations more or less shaded.

As the plant had never before been found west of the Mississippi River, the discovery is important, because it shows a greater geographical range than the species was supposed to have. It occurs in Kentucky and East Tennessee, and probably will be found across the northern part of this state. The species is not confined to the streams, but has been found upon isolated ledges several miles inland.

Notholæna dealbata, Kunze, grows in northwestern Arkansas abundantly, on limestone ledges which are isolated and have a southern exposure. This species, so far as I know, has never been reported from this state, nor farther south than Kansas.—F. L. HARVEY, *Ark. Ind. Univ., Fayetteville, Ark.*

REPLY TO MR. MEEHAN'S CRITICISMS.—*Aquilegia chrysantha.* In Mr. Meehan's observations on the Wheeler Report "it does not strike those acquainted with the" book and its contents "as being particularly careful records of the facts." For Rothrock says that *A. chrysantha* is "hard to distinguish from *A. cærulea* by any mere description, as they exhibit transition at all points" (Wheeler Rep., p 59, lines 1 and 2). This is not only a similar observation, but also a stronger

statement than mine. Mr. M. has erred again in quoting Rothrock as saying that the flowers are "*always yellow*," "italicizing the words." Mr. R. does not italicize both words and does not say the flowers are always yellow in any but *southern* specimens.

It does not follow because Mr. M. camped at Colorado Springs once that all the species inhabiting its vicinity were found by him. It is as likely that he overlooked *A. chrysantha* as it is certain that he failed to find *Stipa pennata* var. *Americana*, *Anemone cylindrica*, *Psoralea hypogæa* (in the streets), *Asclepias Hallii*, *Eritrichium leiocarpum*, *Pedicularis procera* and many others that I found there, blooming at the same time as *A. chrysantha*. I will say that I have made Colorado Springs my home the greater part of two seasons, doing little else than collecting (securing 1100 species), and would be more apt to know its flora than a transient visitor or even one who camped there once. Besides, Mr. Brandegee found the plant in the Grand Canon of the Arkansas, not 30 miles away in an air line (*Flora Col. p. 4*). My notes were drawn from specimens in my herbarium collected by me at different times and places.

(1) Some specimens have the sepals narrower than petals. (2) Others, broader; sepals 1 inch long, petals over ¾ inch; leaflets 12 to 15 lines wide; spur very slender, 2 inches; sepals broad lanceolate; flowers yellow; plant 30 inches high. (3) Others like (2) except sepals lanceolate or oblong-lanceolate narrower than petals. (4) Like (2) except leaflets 6 lines wide (plant as tall). (5) Like (2) except sepals and petals almost equal; sepals and spurs b ue; plant 24 inches high. (6) Others like (2) except leaflets 2½ inches wide; flowers size of (2) or one-fourth smaller.

Two years ago specimens of this plant were taken up and set out at Colorado Springs. The flowers were yellow when taken up but have been blue since. I have seen the plant in bloom.

Malvastrum coccineum is common on the plains, often in large patches. There is no other common plant (on the p ains) known to be poisonous (except the "Loco" which does not act that way). That 1,200 sheep died in 4 hours after being turned upon a large patch of *M. coccineum* the owner of the sheep knows too well. Botanists can afford to wait a chemical analysis of the plant, but stockmen cannot.

Neillia Torreyi. The "thick pubescence" does not "follow all the forms found in Colorado." I have specimens with glabrous pedicels and calyx. Mr. Meehan's distinction of acute, apiculate sepals in *N. opulifolia*, and obtuse sepals in *N. Torreyi* holds good in all my specimens. The pubescent pods of *N. Torreyi* and glabrous pods of *N. opulifolia* do not seem to be constant, at least I have a number of specimens with very slender pedicels, 2 inches long, pedicels and calyx either glabrous, slightly pubescent or woolly; leaves 3 inches by 2 inches, slightly three lobed, and doubly crenate (not incised); flowers 35 to 40; pods as densely pubescent as Utah specimens of *N. Torreyi*.

Smilax herbacea, L. var *inodora* I found August 8, 1878, in Platte

Canon, but having only the fruit I delayed naming it till I secured the flowers. – MARCUS E. JONES.

NOTE. – Since writing the note on *Malvastrum coccineum*, further correspondence leads me to believe that the large number of sheep lost by Mr. Ruble was caused largely, if not wholly, by poisonous water oozing out of an embankment in the midst of a large patch of *Malvastrum*. I am glad to be able to add this item of evidence in favor of the plant. There are, however, a number of other complaints about this plant yet to be settled. – M. E. J.

THE FLORA OF ST. CROIX AND THE VIRGIN ISLANDS, by Baron Eggers. – This is No. 13 of the Bulletin of the U. S. National Museum and is quite a thick pamphlet, containing 133 pages. Some 21 pages are devoted to a general description of the position, geology and climate of the islands, with remarks upon the characteristic plants. The vegetation is divided into four groups, called the "littoral," the "shrubby," the "sylvan," and the "region of cultivation." The author comes to the conclusion "that at a former period all the West India islands have been connected mutually, and perhaps with the American continent also, during which time the plants in common to all the islands, as well as to the West Indies and the continent, have expanded themselves over their present geographical areas, at least as far as they are not possessed of particular faculties for emigration over the sea."

Then follows a catalogue comprising 1,013 species of phænogamous and vascular crytogamous plants, of which 881 are indigenous and 132 naturalized. The proportion between Mono- and Dicotyledonous plants indigenous and naturalized is 1 to 5.8; in the indigenous ones alone 1 to 4.9, thus showing the plurality of the recently introduced plants to have been Dicotyledonous. Five new species are described one of which is a *Rhus*. One looks in vain for the familar heading *Compositæ* and hardly recognizes it under the form of *Synantheræ*. It seems strange also to see all the grasses and sedges put before the *Liliaceæ* and the other kindred families, making the highly specialized Orchids the last of Phænogams. The entire absence of all Ranunculaceous plants is a noticeable feature to workers in our more northern flora.

The report is an interesting one in more ways than can be mentioned in a brief notice and is well worth a careful study.

MOTHS ENTRAPPED BY AN ASCLEPIAD PLANT (PHYSIANTHUS) AND KILLED BY HONEY BEES.—Towards the last of September, Mr. John Mooney, of Providence, an observing man, brought us a stalk of *Physianthus albens*, an Asclepiad plant originating in Buenos Ayres, with the bodies of several moths (*Plusia precationis*) hanging dead by their proboscides or maxillæ. It was found that the moths had, in endeavoring to reach the pollen pocket, been caught as if in a vise by one of the opposing edges of the five sets of hard horny contrivances covering the pollinia. A few days after, Mr. Everett A. Thompson,

of Springfield, Mass., wrote us, that he had a plant of the same species which had caught a number of moths of several species, and that in some cases only the heads and tongues of the moths were left, and he attributed this dismemberment to birds, but wrote in the same letter that his father had seen bees sting the moths while alive and struggling. He sent me one of the moths, which proved to be a *Plusia precationis*, the same species as we had observed in Providence, and a honey bee (*Apis mellifica*) which had been seen by his father to attack the moths, and which had a pollen mass of the same plant attached to one of its fore legs. On writing Mr. Thompson that his father's observations were quite new, the hive bee not being known to be carnivorous, beyond its well-known habit of stinging and killing the males of its own species and the bee moths invading its cells, his father, Rev. L. Thompson, of North Woburn, Mass., a careful observer, kindly prepared the following statement:

"I cannot undertake to give an account of my observations of the plant, moths and bees, concerning which inquiry is made, from the standpoint of a scientist, which I do not claim to be, but after pretty close watching, continued for many days, I feel quite confident of the general correctness of the following statement:

"Early in September, of the present year, as I made one of my daily visits to the plant, to me unknown before, the *Physianthus albens*, or Arauja, I noticed among the many moths that had been caught in the flowers, a considerable number of tongues still in the traps, while all, or nearly all, else belonging to the recent captives had disappeared. While I stood gazing, my attention was arrested by two or three bees buzzing immediately around as many entrapped moths that were alive and struggling to get away. Every moment or two, the bee suddenly and furiously darted upon the prisoner and seemed to sting it despite its desperate efforts to escape, The onset was generally instantaneous, but was repeated again and again, and, after the moth became still and apparently lifeless, the bee settled upon it, and, if my eyes did not greatly deceive me, began to devour it. I had previously noticed the tongues but supposed the bodies of the moths had been eaten by birds, though I had not actually seen it done. I cannot therefore positively assert what seemed to me the fact at the time, though I had no other thought, and the fact that so many of the moths had actually disappeared, leaving only their tongues, and, in some cases, other fragments of their bodies, in the shape of legs clinging to bits of casing or skin, satisfied me that the bees had really feasted on animal food as well as upon the nectar of surrounding flowers.

"I did not suppose it to be the honey bee at the time, but a kind of wasp, such as or similar to that whose nest I had sometimes found in sodded banks or terraces and looked upon as an architectural wonder. Yet I did not examine it, and can only say that I saw many, or supposed I did, upon a bed of Nasturtiums and other flowers, a few feet distant from the Physianthus.

"I think I have found as many as three or four different kinds of

moths upon the plant, besides numerous small black flies which, unlike the moth, go down *bodily* into the flower.—L. THOMPSON."

"*North Woburn, Oct. 29, 1879.*"

Upon writing Dr. Hermann Muller in reference to these facts, he replied as follows:

"Lippstadt, Nov. 10, 1879.—*Physianthus albens* has been observed by Delpino as being visited by humble bees and fertilized by their proboscis. It is a new and very interesting fact that *Plusia precationis* is caught by the flowers of this plant and has been found dead suspended by its proboscis. About carnivorous habits of bees, my brother Fritz, in south Brazil, has observed that honey bees (but I do not remember for the moment whether Apis or stingless Brazilian honey bees) licked eagerly the juice dropping from pieces of flesh which had been suspended in order to be dried in the open air. Nothing else as far as I know has ever been published on the carnivorous habits of bees; I hope, therefore, you will soon publish your very interesting observations."

We have also received the following letter from Mr. Darwin, dated Down, Beckenham, Kent, Nov. 23d. "I never heard of bees being in any way carnivorous, and the fact is to me incredible. Is it possible that the bees opened the bodies of the Plusia to suck the nectar contained in their stomachs? Such a degree of reason would require repeated confirmation and would be very wonderful. I hope that you or some one will attend to this subject."

We have also received the following note from Prof. Gray in reference to the subject: "It has long been familiar, and must several times have been recorded, that moths or butterflies and other insects are caught by getting their tongue, proboscis or legs into the chink between adjacent wings of the anthers in *Physianthus* or *Araujia albens*, and *Asclepias*, etc. The anther-wings are very rigid, the groove between them narrows gradually upwards, so that when a leg or proboscis is engaged, an upward pull only fixes it more securely, and the unhappy insects seem rarely to pull backward or downward, which is the only way to get disengaged. As to the rest of your account I know nothing; and should say that the observations need, if not 'repeated confirmation,' at least some confirmation by an etomological observer."

It appears from the fact that the single worker bee received had a pollen-mass attached to one of its fore legs, that it visited the plant originally for the sake of its nectar. For what purpose did it attack, kill the moths and, as it is claimed, "devour" them? We publish the observations of Mr. Thompson and the comments upon them, with the hope that the subject will receive attention next summer.

Since this note has been put in type, Prof. A. J. Cook, of the Agricultural College of Michigan, well known as an apiarian of experience, informs us that *within the hive*, honey bee workers in killing the drones tear them in pieces with their mandibles rather than sting them, and that he has seen them thus kill a humble bee that had entered the hive; it thus appears, what we judge will be quite new to

entomologists, that the honey bee uses its mandibles, at least on some occasions, as weapons of attack, quite as much as the sting; this would also corroborate the exactness of Mr. Thompson's observations. —A. S. PACKARD, JR., *in Am. Naturalist.*

BURSTING OF THE FRUIT OF EUPHORBIA COROLLATA.—Mr. E. E. White, of Lincoln, Iowa, has noticed the bursting of the pods of *Euphorbia corollata*, with a report loud enough to be heard across an ordinary room. An entire plant had been brought into the house with the view of saving the seed and the reports soon took place. This note is given not so much with the idea that this bursting is peculiar to *Euphorbia*, but that it may call out similar observations and thus group them together in a tangible shape.—PROF. WM. C. WHITE.

CHARACÆ. – For the benefit of several subscribers who have expressed a desire to know something of the structure and position of *characæ*, we take from B. D. Halsted's paper upon the "Classification and Description of the American Species of Characeæ" the following description:

The members of this distinct group of Cryptogams are all filamentous, submerged, aquatic plants, to the naked eye either green or ashy gray in color, depending upon the presence or absence of a calcareous incrustation. The plants are attached by a long, colorless, root-like structure to the muddy bottom of the pond or stream in which they grow, and often form dense masses varying according to the species from a few inches or two to three feet in height. They are remarkable for their large thin-walled cells and the cyclosis of their contents.

In number there is something over a hundred species.

Development:—At the upper end of the spore there is first produced by division a thin-walled, hemispherical shaped cell. This cell soon divides into two by a cell-wall parallel to the longer axis of the spore. Both of these new cells increase in size and push themselves out between the separating ends of the fine enveloping spirals, one turning downward to become the primary rhizoid, the other upward to form the proembryo. The proembryo, the upper portion of which is green, consists of but a few alternating nodal and internodal cells. When the Chara plant develops, one of the disc-shaped nodal cells divides up first into two, and afterwards, by successive divisions, into a number of cells, the largest one of which becomes the initial cell, or *punctum vegetationis* of the future plant. From this cell by further growth and repeated cell divisions the Chara plant is developed.

Antheridia (*globules*):—These, the male organs, are situated on the leaves and are often of an orange color, and from .50 to .75 mm. in diameter. The wall consists of eight cells called shields, closely joined by their serrate edges. The four basal ones are somewhat four sided; the upper four triangular. From the center of each shield-cell there projects into the interior of the antheridium an oblong cell called the manubrium. Each manubrium is surmounted by

a smaller cell known as a capitulum. The capitula end in turn in six secondary capitula from each of which grow four long flagelliform threads which are composed of small disc-shaped cells. The antherozoids are borne singly in the cells. When free from the cell the antherozoid is a spirally twisted, naked, protoplasmic body, many times longer than broad, and is capable of a very rapid motion by means of two cilia which are placed near one end.

Sporangia (*nucules*) :—These are the female organs and when mature are usually of an ovoid shape, and .30 to 1.10 mm. in length. The sporangium consists of a large central cell, the spore and five tubes which are coiled closely around it. The sporangium is a transformed leaflet.

Non-sexual organs of reproduction :—Bulblets are found in a number of species; they occur most frequently at the lower nodes of the plant near the surface of the ground, where few or no leaves are developed and the internodes are colorless.

A second method of non-sexual reproduction is found in *Chara fragilis*, which is called by Pringsheim "Branches with naked base."

Classification :—It is difficult to place the Characeæ very close to any other group of Cryptogams. Their method of development, sexual organs, and anatomical structure separate them from the Vascular Cryptogams on the one side, and the Thallophytes on the other; and bring them nearer to the Muscineæ than to any other general group. Of the Muscineæ they bear the most resemblance to mosses. Differing as they do widely, even from the mosses, in being less complex in structure and in the development of the fruit, it seems fitting that the Characeæ be placed in a group by themselves and arranged with the others in the following order, proceeding from the highest to the lowest : *Vascular Cryptogams*, *Muscineæ*, *Characeæ*, and *Thallophytes*.

SAPORTA'S WORLD OF PLANTS.—In the Popular Science Monthly for February is a review of Count de Saporta's work translated from *Revue Scientifique* by Miss E. A. Youmans. The general bearing of the work is well shown by the reviewer's preface. "Men of science, whose patient researches have accumulated the proofs of the theory of evolution, have perhaps found more facts in support of this great philosophical doctrine in the vegetable than in the animal world. When we say the vegetable world, we of course mean chiefly fossil vegetables. It is only by the study of extinct forms, and their comparison with the living flora, that the affinities between actual types and distant ancestors have been discovered. and their mode of evolution revealed. Vegetable paleontology, it is true, is yet in its infancy, and has many great gaps; still, the rapidity with which it is being developed, and the prodigious number of facts that have been already collected, give good ground for the hope that the day is not far distant when we shall have surely determined the ancestral lines of most of our plants. To this the efforts of paleontologists are tending, and their activity is beyond all praise. During the last twenty years their discoveries have furnished the matter for large volumes and for many memoirs, pub-

lished in the reports of academies of science, in the bulletins of geological societies, etc. But the profound lessons derived from these discoveries have hitherto been almost the exclusive possession of scientific men. People of general intelligence, who are interested in all progress, have known little of the results obtained. This injustice could be no longer tolerated. A complete treatise was required, written in a style that all could comprehend, and summing up the progress thus far accomplished; and M. de Saporta, one of the most eminent authorities in vegetable paleontology, has just published such a work."

"The study of fossil flora not only enables us to follow the evolution of plants from their remotest known ancestors to their present actual descendants, but it throws much light upon the past mysteries of the earth, and especially upon the climatic conditions which controlled its surface while the slow revolutions of organic life were going on." We will quote here and there from the review, not having space for the entire article, although one of great interest to all interested in the history of plants. "There exists between a flora and the climate in which it lives a relation so close that, knowing the one, we can represent the other. Palms do not grow in Greenland nor fir-trees on the plains of equatorial Africa. Each climate has its flora, and each flora its climate.

Paleontology has established the permanence and universality of this law; but it has at the same time established a singular fact which remains inexplicable. It is this: the different climates of the earth have not always been what they are now, either as to temperature or distribution. We speak only of those epochs which have succeeded each other since the time of the most ancient known plants. If we transport ourselves in thought to a time toward the end of the Tertiary period, and then, leaving behind us the Quaternary epoch, follow the course of ages, we find, as an increasing enlargement of the tropical zone, that which is equivalent to an increase of temperature for the whole earth. More extended in the Pliocene epoch than in our day, this zone was still greater in the Miocene epoch, and yet greater in the Eocene, and so on till we reach a time when it embraced the whole surface of the earth, bestowing everywhere an equal temperature, feebly oscillating between certain limits. This climatic equality, which, according to Saporta, reaches at least as far back as the time of the coal, would probably cease at the epoch of the lower chalk. Such is the fact established by examination of the flora of different ages."

"Saporta divides the world of fossil vegetables into four great periods: 1. The Primordial or *eophytic*, corresponding to the Laurentian, Cambrian, and Silurian; 2. The Carboniferous or *paleophytic*, comprehending the Devonian, Carboniferous, and Permian; 3. The secondary period or *mesophytic*, commencing with the Trias and reaching to the end of the chloritic chalk; 4. Finally, the Tertiary or *neophytic*, embracing all the formation from the chalk of Rouen up to and including the Pliocene."

"The flora of the eophytic period is unknown. The *debris* which represents it has in general a character so vague that there is yet no agreement upon its true nature. The graphite found in the Lauren-

tian indicates, however, that from this epoch vegetables existed in great abundance."

"Many of these primordial plants are undeniably linked with more modern types, of which they bear the generic form, and prove that this primordial flora is not really separated from that which followed it. We can even affirm that certain Silurian algæ have had a duration so prodigious and a tenacity of character so pronounced that their last direct descendants were living in the European seas in the middle of Tertiary time."

"With the Devonian things changed. The bad state of preservation of fossil vegetables belonging to this formation has not permitted us to study them perfectly; but, from the aspect of those which we possess, we conclude that at this epoch the vegetable kingdom was already vigorous and varied, and that nature while in its infancy put forth the carboniferous flora, the almost inconceivable exuberance of which has never since been equalled." "The plants of this flora belong exclusively to the two classes of vascular cryptogams and gymnospermous phanerogams." "The Permian flora, which succeeded the Carboniferous, is only a pale reflection of it." "Saporta says of the Trias, which commences the Secondary or mesophytic period, that "it appears to correspond to one of those periods of revival where the failing types finally disappear, while those which displace them are successfully introduced. The first leave chasms because they are reduced to a decreasing number of individuals; the last are yet obscure and rare. Both old and young are equally feeble, and, when these two extremes meet, the apparel of nature seems poor and monotonous." At the beginning of the Jurassic period a transformation is already manifest, and we soon find ourselves in the presence of a new flora, where the carboniferous types have disappeared, but where, except some rare monocotyledons, the angiosperms are still wanting. From Spitzbergen to Hindostan, from Europe to Siberia, everywhere the same vegetable forms, so that the character of the Jurassic flora is monotonous, lifeless, and relatively indigent." "We know not under the influence of what conditions organic evolution, and especially the appearance of dicotyledons, has taken place; but we do know that from the commencement of the neophytic period, these plants appear in a multitude of places and multiply with great rapidity." "This revolution," says Saporta, "has been as rapid in its progress as universal in its effects."

NOTES ON FUNGI.—In printing Miss Banning's paper in the January GAZETTE some mistakes were made which should be corrected. In the description of *R. emetica* (p. 7) read "rose-color" instead of "sage-color." *R. alutacea* (p. 7) has "buff-colored" spores instead of "half-colored." In *A. rubescens* (p. 6) from Eastern Maryland the spores measure .0003 x.00032 inch; small plant from Western Maryland .0003 x.00026 inch.

CATALPA SPECIOSA, WARDER.—On page 3 of the January GAZETTE "3½-4 times" should read "3½-4 lines." The date of Dr. Warder's

first publication of this species, in the Western Horticultural Review, is 1853. The dissepiment (p. 3, l. 22,) of *C. bignonioides* is flatter (or more compressed) but not "flat" as is stated.

CORRECTION.—On page 12 in the last GAZETTE, for "coniferous" read "cruciferous."

When in some emergency an editor weakly yields to the temptation of doing some careless "stuffing" he is very apt to repent it at his leisure. Fortunate is he if his patrons are both keen enough and friendly enough promptly to call his attention to the fact and thus prevent a repetition of the offence. The note reprinted from the *Independent* in the last GAZETTE has called forth such an inundation of rebukes and remonstrances as to completely counteract any tendency to "stuff" in the future. We wish to print a part of one of the best of these, from a botanist of high rank, both for our own satisfaction and the benefit of our patrons:

"The *Polypodium vulgare* is certainly not our form of the species, and is very probably not *P. vulgare* at all. But in the story about *Pringlea* the mistakes are very amusing. The statement is:—"One of these (*Pringlea antiscorbutica*) is not only special to the Island, but it is distinct from any known coniferous plant in having powdery pollen and no petals."

All coniferous plants have "powdery pollen and no petals." *Pringlea* is not special to the Island, but occurs on three other groups or islands. It is not *coniferous*, but is *cruciferous*. (This mistake was not the fault of the writer in the *Independent*.—ED.) It has petals sometimes, "1–4, clawed, rosy-tipped, inconspicuous, caducous."

It differs from the crucifers not in having powdery pollen, for all crucifers have powdery pollen, but in that the pollen is produced in greater abundance, and in that the grains are "smaller, and perfectly spherical, instead of ellipsoid with three furrows."

Sir Joseph Hooker thinks the plant is anemophilous, while the rest of the order is said to be entomophilous. *Pringlea* though closely related to *Cochlearia*, has more the habit (and the use) of a cabbage, and as it grows on islands where winged insects are either scarce or wanting, it is not strange that it should be wind-fertilized."

THE BOTANICAL INDEX.—This neat quarterly, published by L. B. Case, Richmond, Ind., still continues to be full of interest, especially to the horticulturist. The press-work and designs are fine, and in the last number a brief summary of botanical progress for the past year, evidently prepared with great labor, is of interest to every botanist.

Botanical Gazette.

Vol. V. MARCH, 1880. No. 3.

EDITORIAL.—Never have our friends come forward more readily to the support of the GAZETTE than in the beginning of this fifth volume. More subscriptions have been received than ever before in the same time. Many letters have come expressing surprise that such a publication as the GAZETTE existed, for the writers had never heard of it. Now this kind of knowledge will have to be spread by botanical friends, as it would be impossible to have the GAZETTE advertised in such a way as to come to the knowledge of every botanist. If our friends, in their correspondence, will mention the GAZETTE and recommend, at least, applying for a sample copy, many persons will be reached who will be glad to become subscribers. The GAZETTE can pay for itself now, but some such effort to increase our subscription list will enable us to pay for plates, by which we can secure some exceedingly valuable articles. That our friends may know in what estimation the GAZETTE is held by our leading botanists and thus feel a confidence in recommending it to any of their friends, we make the following quotation from the American Journal of Science and Arts for February: "It (the GAZETTE) is an organ for communication among botanists, for the prompt publication of notes and observations, and of those contributions to knowledge which every accurate observer may do his part in, but which must be collected in order to be preserved and utilized. New species are published or announced in it, but it is rather an organ for new observations and botanical news. It is well conducted; it is very useful; we learn that it is in a condition which insures its continuance, and that every increase in the subscription will go towards increasing its value. Our botanists should now see that it is worthily supported. Indeed they can hardly do without it."

THE GENUS LEAVENWORTHIA has been almost from the first involved in some difficulty as to the species. Having now some new material, I wish to bring the present state of the case before the botanists of the Trans-Alleghanian States it inhabits in order to obtain from them further collections and observations in the course of the ensuing spring and early summer. With such aid I may then hope to determine the number and distinction of the species.

Two species were originally established by Dr. Torrey; *L. aurea*, with distinct style and embryo nearly straight, and *L. Michauxii*, with style almost wanting and radicle oblique. The corolla of the first was said to be yellow, upon the authority of the original collector, Dr. Leavenworth. Indeed one of his specimens in the Shortian herbari-

um is ticketed "flowers yellow"; the other "flowers golden yellow." Both are from the Irish Bayou settlement [N. E.] Texas," and though Dr. Leavenworth thought they might be distinct species, they differ only that one has all the peduncles radical and one-flowered, while the other is subcaulescent with central peduncle few flowered. The petals show no trace of the yellow color, but rather seem to have been white with a purplish tinge.

Of the second species, described from Dr. Short's Kentuckian specimens, Dr. Torrey could only say that the flowers in his opinion were pale yellow. Dr. Short does not record their color, either in the specimens he sent to Dr. Torrey or in his own herbarium. But all the specimens received of *L. Michauxii*, that is all with an even and rather broad silique and a very short or almost obsolete style, have white or purplish tinged petals with at most a yellow base. But the same is true of all the specimens (of which the color is noted) received from Alabama, Tennessee, etc., which, having their oblong-linear or lanceolate pods surmounted by a distinct and rather slender style, were taken for *L. aurea;* also in plants raised here from seeds in different years. At most the base or claw of the petals was yellow, the lamina white varying to purple. Accordingly, in the Manual, neglecting the style, and the embryo, I referred all these to *L. Michauxii*, and reduced *L. aurea* to a synonym or a yellow-flowered form of it.

But now, with all the available material before me, including a peculiar yellow flowered form recently detected in Tennessee by Dr. Gattinger, I am disposed to recognize four forms as probable species, and I will here note their distinctions, making at the same time an appeal for further information before coming to a full conclusion. The forms or species before me are as follows:

1. L. MICHAUXII, Torr. Silique oblong-linear, not torulose; style very short or none; seeds orbicular and rather broadly winged; radicle very oblique, approximated on one side to the edges of the cotyledons; petals white with purplish tinge and a yellowish claw.—(Tennessee, on rocks at Knoxville, *Michaux*, if this is indeed *Cardamine uniflora*, Michx., but I have noticed that his specimens have a distinct but short style.) Barrens of Kentucky, *Short.* Charlestown, Indiana, *J. M. Coulter.*

2. L. AUREA, Torr. Silique oblong-linear or narrower, not torulose; style conspicuous, commonly as long as the breadth of the silique; seeds of the preceding; but the radicle merely oblique, sometimes slightly so, petals of the preceding or yellow!—Arkansas and N. E. Texas, *Leavenworth*, with flowers said to be yellow. Alabama, *Buckley*, *Hatch*, *Peters*, etc., with petals purple, pale rose, or white, with yellowish base, sometimes fully half inch long.

L. TORULOSA. Silique linear, conspicuously torose; style fully equalling the breadth of the silique; seeds broadly oval, narrowly winged; radicle nearly transverse, strictly applied to the edges of the cotyledons at the base on one side; petals purplish with a yellow base.—Barrens of Kentucky, *Short.* Very abundant near Nashville, Tennessee, *Dr. Gattinger.*

L. STYLOSA. Slender, strictly stemless; silique or rather silicle

oval or broadly oblong (about 4 lines long and fully two inches wide), plane, surmounted by a slender style of fully 2 lines in length; seeds only 3 to 6, orbicular, distinctly winged; embryo as in the preceding; petals pure golden yellow.—Cedar barrens, Lavergne, near Nashville, Tennessee, *Dr. Gattinger*, June 2, 1879.

Fresh specimens and notes are solicited by ASA GRAY.

AUTOMATIC MOVEMENT OF THE FROND OF ASPLENIUM TRICHOMANES.—Mr. E. J. Loomis, of the Nautical Almanac office, Washington, recently showed me a phenomenon which I suppose has never before been noticed, and which is commended to the attention of botanists. A tuft of *Asplenium Trichomanes*, gathered last autumn in the mountains of Virginia, is growing in his house, in a glass dish. About two months ago he noticed that one of the fronds—a rather short and erect one which is now showing fructification—made quick movements alternately back and forth, in the plane of the frond, through from 20 to 40 degrees, whenever the vessel was brought from its shaded situation into sunlight or bright daylight. The movement was more extensive and rapid when the frond was younger. When I saw it on the 23d of January, its compass was within 15 degrees, and was about as rapid as that of leaflets of *Desmodium gyrans*. It was more rapid than the second hand of a watch, but with occasional stops in the course of each half vibration. This was in full daylight next a window, but not in sunshine. No movement had been observed in the other fronds, which were all sterile and reclining, with the exception of a single one which was just unfolding, in which Mr. Loomis thinks he has detected incipient motion of the same kind.

It is very easy to obtain this little fern and to set it growing. We may expect further observations to be made upon it without delay.—ASA GRAY.

HOW TO MAKE PERMANENT BOTANICAL OBJECTS FOR THE MICROSCOPE.—In the GAZETTE for September, 1879, I had a short paper on staining and double staining of vegetable tissues. I desire now to add a few hints on the previous and the subsequent stages of the preparation.

Mounted objects may be divided into two classes, i. e., the opaque, and the transparent;—the former to be seen by a light (more or less strong) from above, and the latter by light passing through the object from below.

The first thing for the preparer to decide upon, is, which of these two classes shall any object come under?

If the former, the preparation is extremely simple. The whole problem resolves itself into making a suitable case for the treasure. To give a tangible idea suppose we have the seed of a Portulaca or the scarlet tip of a Cladonia, or the yellow apothecium of a Thelochistes. The first thing to do, is to see that your cage (or to speak strictly, your cell) is opaque and of sufficient depth to hold the object. Opticians now keep wooden slides with a central concavity ready to close by placing over it a glass cover. These are cheap and neat.

Or you may take the ordinary glass slide and fasten on to it by marine glue, the rubber, glass, block tin or other cell of any desired depth. Any ordinary work on the microscope will give instructian on the use of this or similar cement. Supposing now that the cell is made and fastened to the glass, I then paint a thick coat of the asphaltum cement over the whole bottom (inside) of the cell so made. This gives you an opaque field. When the object has been properly prepared, by cleansing, I put another coat of the asphaltum on over the first, and on this I place the object. There it becomes cemented as the varnish hardens and nothing is left save to put on a cover of the same or nearly the same diameter as the cell, and then lay on over the outer margin a ring of asphaltum, zinc or any suitable cement, which excludes the air and fastens the cover. This is all sufficiently simple. And it may be well to add that opaque objects are too much neglected because they are not to be used with other than a low power. The smaller lichens may thus be mounted bodily, and so far as their mere external characteristics go, studied more satisfactorily than by any other method. Besides we may then have them safe, handy, and in permanent keeping. Type specimens, if small, should as a rule be so preserved.

The second class:—objects through which the light is seen, i. e., transparent objects. Some are so thin as to need no sectioning and may, or may not, require the bleaching process described in my previous paper. Suppose they are not so thin! How are they to be made so? Evidently by a sharp knife of some form There are costly instruments of this kind made. Allow me to assure you, the assertion of dealers to the contrary notwithstanding, that you do not need any such knife for any ordinary work. A razor sharp enough to shave with is the best and handiest instrument you can use. Neither do you need to have the hollow ground out of one surface providing you hold it as you should hold things, i. e., with a firm hand. So then you may well be satisfied with a good razor; providing always that it be sharp. Next! How shall the object be held whilst being sectioned? First:—it may be held in the hand and if the cutting hand be reasonably steady a good section may be secured. Second:—it may be held in an instrument where it is simply screwed fast, and after the first cut gives you a flat surface, by a turn of a screw in the bottom the object thrust forward so that the next cut shall be of any desired thickness. This is my favorite means of holding the object, and if I have one so small that I cannot so secure it, I take a bit of carrot of the proper size, make a slit in this, in which I put the minute object; then I screw it and the carrot fast together. Some use potato as a substitute for the carrot but it is not so good, as the starch grains become separated and adhere to the object giving some trouble to remove them. Other objects too small even for the carrot may be secured by making a paper cone of proper diameter to fit the section holder (section cutter as it is called, but this name should be retained for the knife), then melt paraffine and pour in until you have enough, then in this set your minute objects. Allow the paraffine to harden and with, or without, the paper cone you may screw it into the holder

as you did the carrot. Then, third:—There is a section holder which is to be used only with the paraffine. It is an e egant, somewhat costly instrument, with I think on the whole a more limited range of usefulness than the second form I have described. But whether you take the second or the third form be sure that it has a glass top for the cutting surface. Brass does well for a time. but sooner or later bceomes rough and so blunts the edge of the cutter, which can never be too sharp.

Now as to the act of cutting: some objects may be cut dry, others may be required to be moistened with water or even with alcohol, and a little of the same fluid may be allowed a ong the knife edge to secure a good or uninjured specimen. The value of a section does not (beyond certain common sense limits) depend on its sixe. A small, thin seetion may, nay will, reveal more structure than a large one thick enough to be nearly opaque. Hence, make your object as large as you can to make it thin, but no larger.

Suppose it is made, and made properly, worthy of mounting permanently. How shall we do this? First, remove all dirt by washing in clean water, then remove all air by immersing in water, or glycerine or alcohol, depending upon what you mean to do with it next, and also in which we shall distend or shrink the object least. Remember here the stages I gave in my previous paper concerning tbe repeated alcohol baths it must have before it comes to be rendered clean in oil of cloves. This rids you of all water and makes it as transparent as it can be made. Now if the object has had the preliminary stages in alcohol and oil, its suitable and final mount should be balsam. I have cast aside all balsam with benzols and balsam with chloroform and come down to the slower evaporations—what is *called* balsam pure. Some objects are not injuriously distorted by this process. Indeed some delicate spores even stand it well. But this is not the rule. Spores do not generally tolerate it and retain their original symmetry and size. Hence we must find some other process.

Take for exan.ple a section of *Solorina saccata*—a lichen with charmingly large and handsome spores. I would rid it of air by first putting it in water, then after an hour or two, into glycerine, where it may remain twelve or more hours. And then I mount it in Farrants medium (bear in mind Farrants, not Tarrants medium) which Dr. Carpenter says is made by "dissolving four parts (by weight) of picked gum arabic in four parts of cold distilled water, and then adding two parts of glycerine." Make without heat, stir but don't shake it, and when it is made, strain it through washed cambric, put it into a bottle along with a small lump of camphor which will prevent fungi from developing in the sweet solution. Now, shall you make a cell or not, for your object? Not unless that object is thicker than (for a simple standard) a sheet of writing paper. If however the glass cover cannot be made to remain flat on the slide, or if an appreciable distance exists between the slide and the cover, then you need a cell. What it shall be made of depends upon its required thickness. If a deep cell is needed then you must go back to the rubber, block tin, or other cells such as I have already named. If however you want

a shallow cell, then a ring (run from the turn table) of Bell's cement, of one or two coats is all sufficient. This cement you may make yourselves by dissolving shellac in strong alcohol. It has the very great merit of drying very quickly and of resisting the action of glycerine, the last a most important quality. Put then your Solorina or other like object in the Farrants medium, with or without cell, and cover it with thin glass, put on so as to drive the air out by *pressing* down one side first and then slowly lowering the other to the horizontal, and under the gentle pressure of a wire clamp allow it to harden. Next remove the exuding surplus medium and in a few hours run from a brush a coat of Bell's cement around the edge of the cover and your slide will be done. These processes are more simple than they appear from a description. Carbolized or camphor water is also a good medium for mounting spores or sections of lichens and fungi in.

As for instruments; whilst I do not regard the turn-table or the section holder as essential, I do consider them as most important aids.

One other point. To clean glass covers I fill a small wide mouthed bottle with strong sulphuric acid, then *one by one* dip in my covers; then they are thoroughly coated with the acid, then after remaining in the acid several hours I pour it off, and by repeated washing in clean water remove most of the acidity, then I put in Labarraques solution, and after a few hours in this I pour it off and wash the bottle and glass with two or three waters and the covers are clean. To keep them so, I put in clean water, and cork the bottle. And to use the covers you have merely to dry them and they are ready for service.

In the above, hastily written, simple statements I have advanced little or nothing new, but have given the modes my own experience has approved, without regard to the sources whence they were derived. It is however fair, that I should state my attention was called to the great value of Bell's cement and Farrants medium by my friend, Prof. Barbeck, of Philadelphia, a most accomplished cryptogamic botanist.—J. T. ROTHROCK.

PTERIS AQUILINA.—I have received from Mr. F. A. White, an esteemed Florida correspondent, a specimen of *Pteris aquilina*, var. *caudata*, which measures 13 feet and 4 inches from the base of the stipe to apex of frond. The stalk measures from ¾ to 1 inch in circumference in its present dried state, and is exactly 6 feet in length, thus leaving 7 feet and 4 inches as the length of the frond. The first internode is 22 inches, the 2d, 16¼ inches, the 3d, 10¾ inches with a corresponding decrease up to the 16th internode which measures only ½ an inch, the apex measuring 2 inches, and the remaining measurements being taken up by the spaces occupied by the bases of the connecting stalks of the primary divisions.

As the primary divisions were taken off to admit of folding the stalk and rachis for mailing without breaking, I can only guess at the probable breadth of the frond; but as the frond of the common brake is nearly triangular in outline, and generally quite as broad at the base

as it is long, this one could not have spread less than 7 feet across the lower primary divisions, each one of which must have been 3 if not 3½ feet long with a corresponding breadth at the base.

The specimen was found in Brevard county and Mr. White writes me that there were others equally as large, *if not larger* in the same hummock.

Nearly all of the English authors state that the common brake in England often attains the height of 10 and 12 feet, and Hooker mentions that Dr. Spruce saw it growing in the Andes 14 feet high, but the dimensions of the present huge specimen exceed any heretofore recorded in this country, and make the old tradition of the Duke of Monmouth's hiding beneath the shelter of a clump of this fern both possible and probable.—GEO. E. DAVENPORT, *Medford, Mass., Feb. 10th, 1880.*

COLORED FLOWERS AND INSECTS.—I am sure many readers of the BOTANICAL GAZETTE feel indebted to your correspondent who showed in the last number that *Pringlea* was a cruciferous and not a coniferous plant, with some other facts in regard to the Flora of Kerguelen's Land. It would I am sure add to our obligation if he would tell us whether on this Island, or on "islands where winged insects are either scarce or wanting" there are plants with flowers having showy petals, or other properties attractive to winged insects. It does not, as he remarks, seem strange that a plant with inconspicuous flowers should exist where there are no winged insects to carry pollen,—but the converse which the *Pringlea* case may have been intended to illustrate, might be worthy of consideration. What I have read of *Pringlea* indicated a belief that it had in the past either failed to develope showy petals, because no winged insects had ever encouraged it to do so,—or that these showy petals became inconspicuous, after having lost, what it formerly enjoyed, the opportunity to secure insect aid,—but it would be interesting to know why other species have not gone and done likewise, if any such there be. Perhaps it is in this direction that the interest in *Pringlea* centers, as much as in whether it is a "cruciferous" or a "coniferous" plant. While this error certainly served to amuse, the information sought may instruct us.—*.

GROWTH OF TREES.—At a meeting of the Botanical Society of Edinburgh, held on Thursday, Jan. 8th, Sir Robert Christison read a paper of very considerable importance on the relative growth of the trunks of trees during 1879, as compared with 1878. Upwards of two years ago Sir Robert set on foot a system of measurements of the girths of a large number of well grown trees in Edinburgh and neighborhood, the measurements being made by himself with the same measuring-line and the same circumference to be measured secured by marking it at the time of first measurement with paint. The inclement character of the summer months of 1879, as compared with 1878, was described by reference to the daily maximum temperatures noted at the Edinburgh station of the Scottish Meteorological Society from

which it appeared that for the six months ending with September the mean for 1879 was fully 5° less than for 1878, the deficiency of day temperature amounting to nearly 10°. Of 11 deciduous trees, exclusive of oaks, the deficiency of growth during 1879 as compared with 1878 was 42 per cent.; of 17 evergreens of the pine tribe the deficiency was 20 per cent.; and of 7 oaks the deficiency was 10 per cent. The 7 oaks were of different species but they gave results closely agreeing with each other.—*Nature.*

BULLETIN OF THT TORREY BOTANICAL CLUB.—After ten years of quiet unassuming life, this publication has blossomed out in a fashion that gratifies its friends. Vol. VII, No. 1, appears with a cover, 12 pages of reading matter and two plates. Four years ago the Bulletin complimented us by saying that we had patterned after it, and now we intend to return the compliment and say that the Bulletin has at last followed the example set by the GAZETTE as to number of pages and cover and surpassed us in the matter of plates. The number before us contains four articles, the first page being devoted to proceedings of the Torrey club; the next seven are taken up by an article from Mr. C. F. Austin, in which he makes some very severe criticisms upon Lesquereux and James' last paper upon North American Mosses. Then comes a description of a new fungus, by W. R. Gerard, and it is to this that the two plates are devoted. The new fungus is a species of *Simblum*, a genus hitherto considered exclusively tropical. The type specimens were collected in Long Island. The fourth paper is a short list of plants, being additions to the flora of Richmond county, N. Y.

So the number ends, with no intimation whether this new order of things is to be kept up or not, probably deeming it safer to promise nothing. But, seriously, we are charmed with this evidence of progress and we wish our esteemed contemporary all the success it so richly deserves.

GOOD NEWS TO BOTANISTS.—The following correspondence explains itself. The facts stated may not be new to some exchangers, but have never been made known before from official sources.

LAFAYETTE, IND., Jan. 15, 1880.

D. M KEY, P. M. General, Washington, D. C.:

DEAR SIR.—Under the present law cannot labels such as the enclosed (an ordinary botanical label) be placed in a package of specimens of dried plants without subjecting them to higher than merchandise rates? Very Respectfully,

CHAS. R. BARNES.

POST OFFICE DEPARTMENT, OFFICE OF THE FIRST ASSISTANT POSTMASTER GENERAL.

WASHINGTON, Jan. 24, 1880.

Respectfully returned to Charles R. Barnes, Esq., Lafayette, Tippecanoe county, Indiana, with the statement that under the provisions of section 231, Postal Laws and Regulatians, labels, such as that

submitted, may be sent with packages of botanical specimens without subjecting them to a higher rate of postage.

JAMES H. MARR,
For First Ass't P. M. General.

RHODE ISLAND PLANTS.—I have to report the finding of *Aster concolor*, L., at S. Kingston, R. I., by Miss Barstow, of Providence, and of *Aster Herveyi*, Gray, at Tiverton, R. I., by Prof. C. S. Sargent, of the Harvard Arboretum. They are good additions to our peculiar flora.—W. W. BAILEY.

NEW SPECIES OF FUNGI, BY CHAS. H. PECK.—STEMONITIS MORGANI.—Plants crowded, growing from a well-developed hypothallus, one-half to two-thirds of an inch high; sporangia cylindrical, three or four times the length of the stem; stem black, shining, prolonged as a columella nearly to the apex of the sporangium; meshes of the capillitium very large, the knots sometimes thickened and subtriangular; spores violet-brown, globose, .0003 of an inch in diameter, with a slight ferruginous tint in the mass.

Decaying vegetable matter. Ohio. *A. P. Morgan.* Pennsylvania. *W. Barbeck.*

Externally this species closely resembles *S. fusca*, from which it seems necessary to separate it because of its paler slightly ferruginous-tinted spores and the very large surface meshes of its capillitium. The spores are larger and in the mass considerably darker than those of *S. ferruginea.*

CONIOTHYRIUM MINUTULUM.—Perithecia minute, .0045–.0055 of an inch broad, scattered, subglobose or depressed, black; spores minute, oblong-ovate or elliptical, colorless, .00015–.00016 of an inch long, about .00008 of an inch broad.

Whitened decorticated surface of hard wood. Vermont. *C. G. Pringle.*

The perithecia are so minute that they are scarcely visible to the naked eye. The upper part of the perithecium ruptures irregularly and at length falls away leaving the lower part sunk in the matrix.

This and the other Vermont species here described were collected by Mr. Pringle, but communicated to me by *Mr. C. J. Sprague.*

LEPTOTHYRIUM CHROMOSPERMUM.—Spots none; perithecia amphigenous, scattered, orbicular, membranous, easily separating from the matrix, wrinkled when dry, black, about .015 of an inch broad; spores numerous, regular, elliptical, colored, .00045–.00055 of an inch long, .00035–.0004 of an inch broad.

Living rose leaves. Ohio. *T. Taylor.*

The perithecia are easily scraped from the leaf by the blade of a pen-knife. The base is margined by a thin colorless membrane which comes off with the perithecia. The spores in the mass have a pale yellowish-brown color.

PHOMA ALBISTRATA.—Perithecia minute, .007–.008 of an inch broad, seated on a thin whitish crustaceous stratum, scattered, conical or subglobose, nearly free, easily separated from the matrix, black;

spores ovate-elliptical, slightly colored, binucleate, .0002–.0003 of an inch long, .00016–.0002 of an inch broad.

Bark of arbor-vitae. Vermont. *C. G. Pringle.*

This fungus is sparingly accompanied by a *Sphaeria* to be hereafter described. I am not sure that the whitish crust belongs to or has anything to do with the fungus. Its presence may be accidental but it occurs in all the specimens before me. The spores are brownish in the mass.

PHOMA COLORATA.—Perithecia minute, .006–.008 of an inch broad, nearly free, hemispherical or subconical, sometimes depressed when dry, black; spores minute, broadly elliptical, simple, colored, .0002–.00025 of an inch long.

Surface of wood. Vermont. *C. G. Pringle.*

This species is closely related to the preceding one but is accommied by no whitish crust and the spores are smaller, more highly colored and destitute of nuclei. They are brown in the mass. The perithecia grow intermingled with species of *Patellaria.*

SEPTORIA CONSOCIA.—Perithecia minute, .0025–.003 of an inch broad, closely gregarious, amphigenous, black; spores filiform, nearly straight, .0006–.0008 of an inch long.

Living or languishing leaves of Seneca snake root, *Polygala Senega.* Michigan. *V. M. Spalding.*

The perithecia manifest a tendency to grow in groups or clusters. They are associated with a species of Æcidium.

SEPTORIA IRREGULARE.—Spots small, angular, often confluent, at first yellowish above, then reddish-brown with a narrow darker border, brown or grayish-brown beneath; perithecia hypophyllous, sometimes amphigenous, irregular, black; spores numerous, filiform, colorless, .0012–.0018 of an inch long.

Living leaves of poison sumach, *Rhus Toxicodendron.* Illinois. *J. Wolff.* Communicated by *S. A. Forbes.*

This is clearly distinct from *rhoidis* B.&C. in the spots, perithecia and spores. The latter sometimes appear as if obscurely uniseptate.

DISCELLA VARIABILIS.—Perithecia orbicular oblong or hysteriform, rupturing irregularly and revealing the pallid or blackish disk, black; spores elliptical-oblong, colorless, .0003–.0004 of an inch long, about .0016 of an inch broad.

Decorticated surface of wood. Vermont. *C. G. Pringle.*

When moist the perithecia open more widely and then by reason of the toothed margin the orbicular ones resemble species of Phacidium. The elongated ones resemble species of Hysterium or Triblidium. They are often partly concealed by the overlying fibers of the wood.

SPORIDESMIUM MINUTISSIMUM.—Spores irregular, multicellular, opake, without any distinct base, generally subglobose or broadly elliptical, .0005–.00065 of an inch long, collected in minute, scattered black tufts which are .004–.005 of an inch in diameter.

Whitened surface of decaying wood. Vermont. *C. G. Pringle.*

ÆCIDIUM JAMESIANUM.—Spots suborbicular, yellowish-green; peridia mostly hypophyllus, rarely amphigenous, loosely clustered, pustuliform, opening by a small aperture; spores subglobose, .0008–.001

of an inch in diameter, orange-yellow, with a thick hyaline epispore.

Living leaves of *Asclepias Jamesii*. New Mexico. *T. S. Brandegee*. Communicated by *E. A. Rau*.

This species is quite distinct from *Æ. Brandegei* which also occurs on Asclepias leaves.

LECYTHEA MACROSORA.—Sori amphigenous, large, pulvinate, yellow, surrounded by the ruptured epidermis, often crowded or confluent; spores obovate or subglobose, rough, .0006–.0008 of an inch long; paraphyses smooth, capitate, the globose or obovate head .001–.0012 of an inch long.

Living leaves of *Epilobium tetragonum*. Colorado. *T. S. Brandegee*. Communicated by *E. A. Rau*.

SOROSPORIUM ATRUM.—Spore balls very unequal, .0006–.0016 of an inch in diameter, polymorphus but most often subglobose, composed of a few or many spores according to the size, compact, separating with difficulty into their component spores, black; spores subglobose, minutely granular, .0003–.0005 of an inch in diameter.

Perigynia of *Carex Pennsylvanica*. Colorado. *M. E. Jones*.

The fungus fills the perigynia with its black dusty mass of spore balls. It was found in June at an altitude of about 6000 feet.

CHEIROMYCES TINCTUS.—Scattered, black, erumpent in minute hysteriiform chinks; spores with two to five divisions, .0005–.0008 of an inch long, one to three septate, often a little constricted at the septa, tinged with blue.

Decaying wood. Vermont. *C. G. Pringle*.

In external appearance this resembles very closely *C. Beaumontii*, B.&C., of which Dr. Curtis distributed specimens but of which I have seen no description. In it the spores are smaller, of a brown color and destitute of septa. The blue color of the spores in the present species is clearly seen when the fungus is moistened and crushed on the side of the microscope.

PEZIZA SPONGIOSA.—Cups large, one inch or more broad, concave or infundibuliform, thin, soft, externally black, the hymenium blackish brown, becoming porous when old; stem short, slender, black; asci cylindrical; spores uniseriate, globose, smooth, granular within and often uninucleate, .0005 of an inch in diameter; paraphyses filiform, colored, circinate or uncinate-curved at the tips.

Ground under fir trees. Near the summit of Mt. Mansfield, Vermont. May. *C. G. Pringle*.

The hymenium in all the specimens is porous or spongy. I am not sure that this character exists in the young and fresh plants. It sometimes occurs in *Peziza badia*. The description was derived from dried specimens and the colors may not accurately correspond to the hues of the fresh plant. The globose spores and colored paraphyses with hooked tips are distinguishing characters of the species. It belongs to the section Cupulares.

PHACIDIUM SPARSUM.—Perithecia minute, .014–.02 of an inch broad, few, scattered, black, with a few blunt teeth and a black disk; asci short, clavate; spores crowded, oblong, sometimes slightly narrowed toward one end, colorless, .0005–.0006 of an inch long, about

.00016 of an inch broad; paraphyses filiform, often longer than the asci.

Decaying wood. Vermont. *C. G. Pringle.*

This fungus is easily overlooked by reason of its small size and scattered mode of growth. The marginal teeth are sometimes obsolete and then the plant looks like a Triblidium.

STICTIS FULVA.—Receptacle erumpent, slightly margined, thin, orbicular or oblong-elliptical, about one line long, pale tawny or subochraceous; asci subcylindrical; spores nearly colorless, oblong-elliptical, .0006–.0008 of an inch long, .00025–.0003 of an inch broad, sometimes containing one or two nuclei; paraphyses filiform

Decaying wood. Vermont. *C. G. Pringle.*

This fungus belongs to the subgenus Propolis as indicated by its dusty-appearing hymenium. It is very closely related to *S. versicolor.*

DIATRYPE ANGULARE.—Stroma small, scarcely one line broad, erumpent, externally black or blackish-brown, within slightly reddish-brown; perithecia large, few, one to six; ostiola very prominent, angular, compressed or pyramidal, asci cylindrical; spores large, uniseriate, uniseptate, colored, oblong or elliptical, obtuse, very variable in length, .0011–.0022 of an inch long, .0006–.0007 of an inch broad.

Bark of bass wood, *Tilia Americana.* Vermont May. *C. G. Pringle.*

The stroma does not penetrate to the wood. The very prominent angular ostiola are often arranged in such a manner as to give a radiate-sulcate appearance to the upper part of the stroma. The spores are black in the mass and the longest ones are sometimes slightly narrowed in the middle.

SPHÆRIA ALTIPETA.—Perithecia minute, subglobose, immersed, black; ostiola emergent, subconical or cylindrical, nearly as long as the perithecia; asci cylindrical; spores uniseriate, oblong, colored, .00065 of an inch long, about .0002 of an inch broad, hyaline at one end, uniseptate near the other.

Decaying wood. Mt. Washington. *C. G. Pringle.*

The perithecia sometimes occur in long lines. When young the spores are colorless, but they soon become colored, except at one end, and contain two nuclei. Finally a septum is formed near the colored end of the spore. The species should be referred to the Ceratosomæ.

SPHÆRIA LICHENALIS.—Perithecia scattered, minute, .008–.011 of an inch broad, subhemispherical, erumpent, black; ostiola papilliform; asci oblong elliptical; spores crowded, oblong, multiseptate, fenestrate, greenish-yellow, .0014–0016 of an inch long, .0004–.0005 of an inch broad.

Bark of Birch trees. Vermont. *C. G. Pringle.*

The perithecia occupy a discolored spot which gives a lichenose aspect to the fungus. Sometimes two or three are seriately crowded or confluent, in which case they present a hysteriiform appearance to the naked eye. The species, though peculiar in its habitat, may be referred to the section Pleospora.

COLUMBIA COL
HERBARIUM
NEW YORK

Botanical Gazette.

Vol. V. APRIL, 1880. No. 4.

EDITORIAL.—Now that the season for collection and observation is upon us, it seems appropriate to call the attention of botanists to the importance of systematic and recorded work. Many points of interest in systematic botany are still waiting to be settled, while observations in the department of physiology have been but begun. Elsewhere we have spoken of the great advantage of forming clubs for the better prosecution of this work, where such a thing is practicable. Of course some workers are necessarily isolated and must be carried through these labors by a pure love for them. But whenever a few can be brought together in a neighborhood and be induced to form a Botanical Club or a Natural History Society, the interest that will certainly be aroused and the enthusiasm with which observations and collections will be made will be productive of large results. There is a great deal of misdirected energy in botanical work, as well as in every other department of science. A man will collect, observe, record facts, spending much valuable time in getting together material that has already been collected, or is not important enough to justify the trouble. Magnifying small things is the great tendency in the amateur, who directs all his enthusiasm towards noting little distinctions and making them of such importance that he really cannot be made to realize that it all amounts to nothing. How many trivial letters from such misguided observers are sent annually to our leading botanists it would be hard to say. The worst of it is that these botanists are compelled to submit to such impositions in the hope of gleaning now and then a few grains of wheat from all this chaff. Now it is the tendency of botanical clubs to check such indiscriminate work. While through them the enthusiasm is greater, and interest in botany is rapidly disseminated, work can be better directed and made really valuable. Clubs can put themselves in communication with the best botanists, can become informed of the work that has already been done, and that is still waiting to be done. Members adding together their information will be surprised how they can act as checks upon each other. Persons desiring to form a club, but not having experience sufficient to know the best methods, have only to send to the Torrey Club of New York for a copy of the constitution and by-laws. Then when a club is formed, and the work begun, care should be taken not to be so wrapped up in self as not to let any one outside know what is being done. It has always seemed as if it should be one of the important duties of a club to publish what is worth publishing of its work. The simplest and most appropriate way for this to be done is for the secretaries of all botanical clubs to make it a part of their duties to send a synopsis of the proceedings of each meeting to the editor of the *Torrey Bulletin* or the editor of the BOTANICAL

GAZETTE, and let these gentlemen cull out what seems suitable for publication. This is given as a suggestion and from an earnest desire to reach in some way the good work that is being done and to turn into useful channels energies that are being wasted. We mention these two publications only, because they are the only ones entirely devoted to the interests of botanists. Other journals could be mentioned, but such notes as we speak of would not seem so fitting in them as more elaborate papers. There is good work enough to record to keep the *Torrey Bulletin* and the GAZETTE both busy in simply selecting the most important facts, and we hope that soon their pages will have to be increased in number to hold the notes which will come in on them like a flood.

GERMINATION AND GROWTH OF PARASITIC PLANTS.—Much interest has been manifested recently in regard to the germination of that class of plants which have heretofore been regarded as parasitics, and advocates are still found of both theories,—that they may germinate without attachment to a mother plant, and, that it is requisite for germination. Lindley says: "According to the observation of Vaucher of Geneva, the seeds of *Orobanche ramosa* will lie many years inert in the soil unless they come in contact with the roots of Hemp, the plant upon which that species grows parasitically, when they immediately sprout. Schlauter states that they only seize seedlings, and are unable to attach roots of stronger growths." In the summer of 1878, I collected in abundance near Haddonfield, New Jersey, *Orobanche minor*, (see BOTANICAL GAZETTE, Vol. 3, No. 9, September, 1878,) and as many of the specimens had ripe seeds I scattered them with a liberal hand over the grass plot and flower beds in the yard attached to my residence, hoping thereby for an opportunity to watch their development and growth; but as not a single specimen made its appearance during the following year, I had almost concluded my experiment a failure. A few days ago on going into my conservatory I was surprised to find I was there harboring three specimens, growing in the flower pots with Geraniums. These Geraniums had been transplanted from the conservatory to the yard in the summer of 1878 and hence were growing in the flower beds when the seeds of the Orobanche were scattered. In the fall of the same year they were retransplanted to the conservatory; the same process was repeated in the year 1879. One of the three specimens has been removed from the place of growth, and I have been unable to find an attachment to the roots of the Geraniums in any way, to either the main root or any of the smaller young fibrous roots, hence I am led to believe this plant at least has had an independent existence; the bulbous or enlarged base is much the same as that of the original specimens collected, but there are more fibrous roots attached, and they are more centrally fixed underneath, as may be seen in the growth of the common onion; the specimens heretofore examined had more of a side development, as though the attachment to the root of the parent plant had absorbed somewhat of the substance or caused an unequal growth.

Here we have two facts shown :—that the seeds of *Orobanche minor* may remain in the soil an indefinite time before germinating, and, that they do not require attachment in order to induce germination. As this species is parasitic on clover usually, and may have a preference for that, it is here shown that there may be a growth and full development without such service. One of these specimens measured 10 inches in height and had 45 flowers on it, with a large number of buds undeveloped at the top. I now have hopes that the coming season may give opportunity to watch their development still farther, as more of the seeds scattered in my yard may conclude, if they cannot find the proper foster parent, to grow without one.—ISAAC C. MARTINDALE, *Camden, New Jersey.*

SOME ARKANSAS FERNS.—*Cheilanthes lanuginosa*, Nutt., grows very abundantly upon limestone cliffs in the northwestern part of Arkansas. It can be found upon the escarpments of the wooded valleys that run inland from White river. I have found it inland two miles or more, and always on the north side of the valley in very dry situations, though it seems to like the shelter of projections. Its habitat is about the same as *Notholæna dealbata*, but I have never found them growing together. *Asplenium parvulum* is one of our common species in Arkansas. I have had this doubtful species under observation for several years, and have never been able to find intermediate forms or any reason for regarding it a variety of *A. ebeneum*. This species is found on dry ledges in this region, a situation in which I have never seen *A. ebeneum*. The latter is plentiful here but grows in rocky places in shaded woods. I have observed both species growing within a few feet of each other, in situations moist enough for both, and searched for intermediate forms but without success. Each retained its characteristics.

Cystopteris bulbifera, Bernh , is a common form in the northern part of Arkansas. Specimens from Benton county collected upon rocks in moist places measured nearly two feet long. The species mentioned above have never been reported from Arkansas, so far as I know. *Woodwardia angustifolia* may also be added, as I have seen specimens collected in the swamps of southern Arkansas.—F. L. HARVEY, *Ark. Ind. Univ., Fayetteville, Ark.*

FLORA OF KERGUELEN'S LAND.—The question is asked in the March number of the GAZETTE, whether the flora of Kerguelen's Land, "in which winged insects are either scarce or wanting," contains to any extent "flowers having showy petals or other properties attractive to winged insects." The elaborate recent memoir in the Transactions of the Royal Society, London, may answer the question. There are twenty-one indigenous phænogamous plants now known on Kerguelen's Land. Not one of them is showy flowered; of those that have petals at all the most conspicuous are the three species of *Ranunculus*, which in this respect are about equal to our *R. Cymbalaria*; the others are *Montia fontana*, *Tillæa moschata* and *Limosella aquatica*.—A. G.

Effects of Uninterrupted Sunlight on Plants.—Dr. Schuebeler, of Christiana, has published in the Norwegian *Naturen* the results of some experiments on the acclimatization of southern plants in Sweden and Norway. His first experiments relate to the effect of the almost uninterrupted sun of Scandinavia on winter wheat. Samples from Bessarabia and Ohio sown showed in the first crop an increase in size and weight of grain, together with a deepened color. Increased development of the pigment of plants is shown also in the common garden flowers of central Europe, which when raised in Norway take on richer color. *Veronica serpyllifolia*, for example, changes from pale to deep blue, while *Trientalis Europæa*, naturally white, becomes decidedly pink. Under continuous sunlight also plants which usually fold their leaves at night, such as *Mimosa pudica*, kept them always open. It is also found that the aroma of fruits and vegetables is much increased. Some of the most savory of European garden vegetables when grown in Norway become absolutely disagreeable to the taste. This increase of aroma points to what may and ought to become a profitable industry in the Scandinavian peninsula, viz., the raising of those plants which are valuable for their yield of fixed and essential oils, inasmuch as the per cent. obtainable from a given weight is much increased by growth under these peculiar conditions. But while aroma, which seems thus dependent on light is much augmented, sweetness, depending on heat, is correspondingly lessened by moving northward. This is especially noticeable in small fruits, such as the strawberry, plum, cherry, etc. Dr. Schuebeler's experiments extended over 30 years and doubtless the full text of the communications would be most interesting.—C. R. B.

Red Calyx in Sambucus Canadensis, L.—As the botanizing season is again upon us it may be well to publish the following note of observations made last summer in this vicinity. By accident I found a bush of the common Elder in which every calyx was of an intense bright purplish-pink color, and this was true of all the flowers and unexpanded flower-buds on the whole plant. Pedicels and peduncles were the usual white, but all, including the calyx, were decidedly hirsute. A further examination proved that about one-fourth of all the shrubs in that patch had the calyx more or less tinted there being about 30 in all. During the remainder of the summer I examined a great many plants and found the calyx more or less *colored* and *hirsute* in near one-third observed. In every instance where the calyx was tinted it was also hairy, but in two examples I found the calyx hairy but not tinted. The color was near that of red aniline. The plants that grew in rich alluvial soil appear to be most frequently colored.—J. Schneck, *Mt. Carmel, Ill.*

Observations on Remarkable Forms of Triticum repens.—I am indebted to Wm. Boott, Esq., for the following: "In the English Flora Sir James Smythe says under *Triticum repens*, 'Schrader describes a remarkable state of this grass figured in Leen, t. 12, f. 4, 1,

in which a great part of the spikelets in the lower portion of the spike are double, or in pairs, contrary to the generic character.'" The above remarks were sent me by Mr. Boott, on seeing my lists of 1878 and 1879, which contain some remarkable forms of *Triticum repens*. No. 1578 (from Colorado) is characterized generally by involute, narrow, rigid, faintly nerved leaves, glumes and palets but slightly nerved, short awned. Some specimens have 9 joints to the rachis of spike, lowest joint with single spikelet (as in normal specimens of *T. repens*), the upper three the same, but all the rest with double spikelets at each joint. Another has 11 joints, lowest one double, all the rest single. From the same root is another stalk with 15 joints, lowest one single, next three double, rest single. Others have 13 joints, 7 double (always the lowest double unless stated otherwise); 18 joints, 8 double; 19 joints, 12 double; 22 joints, 15 double. From the same root as last is one with 22 joints, lowest single, next nine double. From Utah, under Nos. 1004a and 1516, are two very distinct forms, (1) the mountain form with broad, flat, green, nerved leaves; broad, acute, green, conspicuously nerved glumes and palets; (2) the form of the dry and heated valleys, with very long and narrow spikelets (over one inch long), whole plant glaucous; leaves rigid, involute, rather short, narrow; glumes and palets almost horny, smooth, scarcely nerved. Under (1), I have two specimens with 13 joints, lowest three triple spikeleted, rest double. Others have 10 to 15 joints, lowest one double, all the rest single. Others have 25 to 30 joints (very long spikes), lowest five double. Under (2), are some with about 18 joints, lower half all double. Others have 18 joints, all single but the third from the bottom, which is double. One other has 18 joints, lowest one double, next two single, next three double, the rest single.

I have many specimens of the most remarkable forms (besides those already sent out) as well as very many of these forms of *T. repens* with only single spikelets. I have shown the most remarkable forms to Dr. Vasey, who considers them remarkable forms of *T. repens*. These forms with double spikelets are not uncommon, for I have found them in many places in Colorado and Utah.

That the distinction of double spikelets in *Elymus* tends to be broken is shown in forms of *E. condensatus* and *triticoides* which often have the lowest joint single spikeleted, and the upper five also. Two or more single spikelets often occur in both the above and in *E. arenarius*, *Sibiricus* and occasionally in *E. Canadensis*.

In most of the eastern species, the glumes of *Elymus* form an apparent involucre, and to the amateur do not seem to be glumes, but in *Elymus arenarius*, L. and *condensatus*, Presl., in all the spikelets of the former and the upper ones of the latter, they are attached to the spikelets as closely as in *Triticum repens*, and more closely than in *T. violaceum*, especially the long awned form. A question asked by one of our leading botanists will find a good place here: "What is there to distinguish *Elymus Sibiricus* from *Triticum violaceum* but the double and single spikelets," and if these fail, what then?—MARCUS E. JONES.

Some Notes of Rare Ferns.—On the trip to Ocala last December we noticed quantities of the beautiful *Aster Carolinianus*, full of large bright blossoms, growing all along the Ochlawaha river. About Ocala the flowers were scarce just then, but I gathered a large number of fine *Asplenium firmum*, two forms of *A. myriophyllum* and two forms of *Pteris Cretica*. When I saw the number of flourishing plants I had no fear of destroying localities, and was able to secure entire ferns for my specimens.

I was also successful in getting a goodly quantity of fruited *Polypodium Plumula* from a monster Live Oak in a deep forest near St. Augustine. This is the first time that I have collected this fern in really good condition. Though one of our prettiest ferns it gives more trouble in pressing than any other one, I think. This is caused by the extreme elasticity of the rhachis, which is so great that the frond *will not* stay as it is placed, and by the rolling up of the pinnæ. Unless placed in an extremely wet atmosphere they will not uncoil, and then they are all ready to curl right up again unless pressed at once. I have collected also excellent specimens of *Acrostichum aureum*. Some of these are simply upper sections of fruited fronds, and some show the entire fertile frond. The latter are five or six feet long and are very handsome ferns.—Mary C. Reynolds.

Rhus Toxicodendron.—I notice in the Gazette for October, 1879, an account of an unusually large specimen of *Rhus Toxicodendron*. As every botanist knows, this species is usually prostrate or creeping over walls and fences and at the north rarely high climbing, the stems seldom more than a half inch in diameter. It was with astonishment, therefore, that I noted during the winter of 1879 the enormous specimens among the timber along the Grand river in the Cherokee Nation. Many of them were not less than six inches in *diameter* and climbing to the tops of the tallest trees, thus rivaling *Tecoma radicans* and *Vitis*.

Here in Missouri the largest trees along the streams have been felled and most of the old specimens of the *Rhus* which clung to them been destroyed; still, very large specimens are frequent. I note that while *R. typhina* is the most abundant species in northern New England, *R. copallina* is largely in excess of the others here in the southwest.—William F. Flint, *Bowers Mills, Missouri.*

Commelynaceæ.—At a meeting of the Linnean Society on Feb. 5, Mr. C. B. Clarke gave an oral *re'sumé* of this order, which he had lately worked out for DeCandolle's "Prodromus." He defined the order by the position of the embryo, as not surrounded by albumen, but closely applied to the embryostega, which is always remote from the hilum. An important auxiliary character is that the three segments of the calyx are always imbricated, so that one is entirely outside of the two others. Mr. Clarke divides the *Commelynaceæ* into

three tribes, as follows: 1. *Polliceæ*, fruit indehiscent; 2. *Commelyneæ*, capsule loculicidal, fertile stamens 3–2; 3. *Tradescantieæ*, capsule loculicidal, fertile stamens 6–5. He also alluded to the manifest and important change of color in the petals of several of the *Commelynaceæ*—e. g., *Aneilema versicolor*, where from a bright yellow when fresh, they become a deep blue when dry.—*Nature.*

AUTOMATIC MOVEMENT OF THE FROND OF ASPLENIUM TRICHOMANES.—In a letter to Dr. Gray in reference to the above article in the March GAZETTE, Mr. E. J. Loomis says: The motion instead of being "in the plane of the frond," is really at right angles to it.

Four other fronds starting from two different roots exhibit motion, but in less degree than the one first noticed. These are not new fronds, but are old ones which were fully developed as to size when taken up, but have fruited since transplanting. It seems to me that the motion is confined, not only to the fruitful fronds, but to the period of fructification, since these four fronds have been subjected to the same condition as the first, but have exhibited motion only since fruiting began.

The stimulus of artificial light is sufficient to excite motion in the fronds for a few minutes, but after the lapse of five or six minutes the motion ceases and is not resumed.

I have noticed that the end of the frond does not describe a straight line but it moves in a long and very narrow ellipse, with the hands of a watch. The motion is more vigorous and through a larger arc in the middle of the day.

SOME FLORIDA FERNS FOR SALE.—Miss Mary Reynolds, of St. Augustine, Florida, has pressed beautiful specimens of some rare Florida ferns. She has a large number of duplicates for sale, and the low prices will enable every botanist interested in ferns to procure specimens. The species are *Asplenium firmum*, *A. myriophyllum*, *Pteris Cretica*, *Polypodium Plumula*, and *Acrostichum aureum*. The first four can be procured for fifteen cents each. Upper sections of the fertile frond of the *Acrostichum* cost from 20 to 60 cents; same with entire small sterile frond, 60 to 90 cents; entire fruited frond, one dollar.

NOTES FROM PAINESVILLE, OHIO.—Dr. H. C. Beardslee has sent specimens of *Scirpus atrovirens*, with the viviparous growth in two stages, one in which there are roots some inches in length. The specimens were on culms which had been broken over and were found lying in the water of a small brook.

Viviparous forms of *Cenchrus tribuloides* were also collected, a thing that might be expected in a plant of its habits.

Dr. Beardslee has also been watching the vegetation of the seeds of *Draba verna*, and the growth of the rosettes of radical leaves which it puts forth. This winter he watched it come into flower, which it did

as early as February 20. He thinks it clearly biennial and would be glad to know from other observers whether it is always so.

Sisymbrium Thaliana, a little later flowering than the *Draba*, is also biennial. In the first week of March it was just beginning to show flowers.

ERYTHRÆA CENTAURIUM.—In the summer of 1878 I discovered three or four fine plants of *Erythræa Centaurium*, Pers., nicely in blossom, on the grounds of the Agr'l Coll., Lansing, Mich. Some time before this Prof. Beal found specimens of the same in an open swamp near by. None have been found in the locality since '78.

Hydrocotyle umbellata, L , also occurs near here on the shores of small lakes.—L. H. BAILEY, JR.

SOME PLANTS OF FRANKLIN CO., KY.—For more than a year past I have been indebted to your GAZETTE for many little things of great interest to me, and I feel that I ought to make some return (or strive to do so) by giving you some of my notes on last year's collecting in this county (Franklin), premising, however, that I am a beginner in botany.

Hepatica triloba and *acutiloba* are both found on the Lower Silurian limestone hills or cliffs of Kentucky River, the latter species more common and often seen with the lateral lobes of the leaves again slightly lobed.

Isopyrum biternatum, T. & G., occurs in similar situations, but is more rare.

Hydrastis Canadensis, L., is common in rich woods and often has an additional leaf, three lobed, just below the flower, making three leaves on the stem.

Menispermum Canadense, L., is common, but it is rare to find a specimen with a woody stem nearly an inch in diameter.

Podophyllum peltatum, L., I found once with but one leaf on the flowering stem. I thought it rather interesting to find on one cliff at some distance from any dwelling three introduced plants, viz.: *Papaver somniferum*, L., *Bupleurum rotundifolium*, L., and *Vinca minor*. The latter covers a large portion of the wooded hill side, while the former grew scattered among the loose stones near the base. How the *Bupleurum* got there I cannot imagine, as I have never seen it anywhere else in the county.

Cardamine rhomboidea, var. *purpurea*, Torr., is common in rich soil at the base of the limestone cliffs.

Arabis patens, Sulliv. is found in the same situations, but is not common.

Vesicaria Shortii, T. & G., is quite abundant in a few localities in similar situations to the above.

Lepidium intermedium, Gray, is rare in dry woods.

Solea concolor, Ging, occurs abundantly in the rich soil on the river

cliffs, along with *Viola pubescens* and var. *scabriuscula*, T. & G. On wooded hill-sides, *Hypericum sphærocarpon*, Mx., occurs with *Tragia macrocarpa*, Willd., which last, according to Gray, has no stinging hairs; but they certainly made themselves felt on the back of my hands and wrists, while unable to penetrate the thicker epidermis of the fingers and palm. —R. H. WILDBERGER, *Ky. Mil. Institute, Farmdale, Ky.*

SYRACUSE BOTANICAL CLUB.—This active club does not confine its attention to field work, but has been busily employed all winter. They have held weekly meetings for the reading of papers on all the important orders of plants, illustrated by specimens collected the season before. Such a course has kept them very familiar with their local flora and we anticipate large results from it during the coming season. They will take the field thoroughly prepared by a season's experience in collecting and a winter of study, and our prophecy is that the summer of 1880 will bring to them richer results than that of 1879. Physiological botany has not been neglected. for they have considered such subjects as "Perfume and Color" in plants, "Complementary Colors," "Motion in Plants" and "Insectivorous Plants."

We write this not so much for the encouragement of the club, for they do not need it, but to call attention to this most profitable way of studying botany where several persons interested in the science are within reaching distance of each other. One person working alone is apt to dissipate his energies over a very broad field and the result is small. But put several workers together and concentrate their work and it brings important results. The little things, which by themselves appear insignificant, when brought together, form an aggregate which is of great importance.

CURTISS' NORTH AMERICAN PLANTS.—There is no better collector of plants than Mr. A. H. Curtiss, of Jacksonville, Fla. Not only does he succeed in collecting the rarest of species, but makes beautiful specimens, and to receive a bundle from him, with species carefully separated and labels handsomely printed, is a pleasure, the full enjoyment of which only a botanist can appreciate. Mr. Curtiss has just issued Fascicle III of his N. Am. Plants. In it are found 215 species and varieties, some 15 being supplementary to Fascicles I and II. The price of this Fascicle, at Cambridge, is eighteen dollars.

TORREY BULLETIN.—The February number is at hand, even handsomer and more attractive than the last. Putting in each month a short synopsis of the proceedings of the club is a good idea, for we all want to know what these clubs are talking about. In the proceedings of this month we notice a peculiar idea advanced by Dr. Jarvis in a paper on "Galls." The idea was not new to us, but its publicity was. It is that the gall insect is a product of the plant. It is contended

that galls are normal products of the plants on which they grow, and that these galls, by an evolution of their protoplasm, eventually give birth to animal life. This seems to "out-evolutionize" the most radical evolutionist.

Mr. Austin describes two new genera of mosses, dedicating one to Capt. J. Donnell Smith and the other to Mr. Eugene A. Rau. Considerable space is devoted to botanical news, a department that could be made exceedingly interesting and important in the organ of a large club so centrally located as the Torrey club. We note with pleasure that Mr. W. R. Gerard has been elected assistant editor of the Bulletin.

THE FUNCTION OF CHLOROPHYLL.—One of the most important recent contributions to physiological botany is contained in a recent communication to the Berlin Academy of Sciences, by Dr. Pringsheim, which appears to throw considerable fresh light on the function of chlorophyll in the life of the plant.

Having been led by previous researches to the conclusion that important results might be obtained by the use of intense light, he combined an apparatus by which the object under view should be brightly and constantly illuminated by a strong lens and a heliostat. If in this way an object containing chlorophyll —a moss-leaf, fern-prothalium, chara, conferva, or thin section of a leaf of a phanerogam be observed, it is seen that great changes are produced in a period varying from three to six or more minutes.

The first and most striking result is the complete decomposition of the chlorophyll, so that in a few minutes the object appears as if it had been lying for some days in strong alcohol. Although, however, the green color has disappeared, the corpuscles retain their structure essentially unaltered. The change then gradually extends to the other constituents of the cell; the circulation of the protoplasm is arrested; the threads of protoplasm are ruptured and the nucleus displaced; the primordial utricle contracts and becomes permeable to coloring matters; the turgidity of the cell ceases; and the cell presents, in short, all the phenomena of death.

That these effects are not due to the action of the high temperature to which the cell is exposed under these circumstances is shown by the fact that they are produced by all the different parts of the visible spectrum. The result is the same whether the light has previously passed through a red solution of iodine in carbon bisulphide, through a blue ammoniacal solution of cupric oxide, or through a green solution of cupric chloride. If the carbon bisulphide solution of iodine be so concentrated that only rays of a greater wave-length than 0.00061 mm. can pass through it, these effects are not produced, although about eighty per cent. of the heat of white sunlight is transmitted. On the other hand, if the ammoniacal solution of cupric oxide be so concentrated that the whole of the rays of a less wave length than 0.00051 mm. are absorbed, a rapid and powerful effect is pro-

duced, although the amount of heat that passes is very small. It is thus seen that the phenomena in question are not the result of heat.

The next point determined by Dr. Pringsheim is that the effects are not produced in an atmosphere devoid of oxygen. This was the case whether the oxygen was replaced by pure hydrogen or by a mixture of hydrogen and carbon dioxide; while the removal of the carbon dioxide from atmospheric air was altogether without effect on the phenomena. The conclusion drawn is that the decomposition of chlorophyll in the living plants is a process of combustion which is influenced and promoted by the action of light, and which is not related to the decomposition of carbon dioxide by the plant. When the green color of the chlorophyll-grains has been partially destroyed, it cannot be restored, even though the cell continues to live; from which it is inferred that the result is not a normal physiological, but a pathological effect. No substance was found in the cells which might be regarded as the product of the decomposition of the chlorophyll, nor was any oil or starch detected in the etiolated cell, nor any formation of grape sugar or dextrine. The assumption is therefore that the products of decomposition are given off in the gaseous form.

The conclusion is drawn that the decomposition produced in the protoplasm, and in the other colorless cell contents, is the direct effect of the photochemical action of light. That it is not due to the injurious influence of the products of decomposition of the coloring matter of the chlorophyll is shown by the fact that it takes place equally in cells destitute of chlorophyll, such as the hairs on the filaments of *Tradescantia*, the stinging hairs of the nettle, &c. It is, on the other hand, dependent on the presence of the oxygen, or is a phenomenon of combustion.

The results of a variety of experiments leads Dr. Pringsheim to the important and interesting conclusion that the chlorophyll acts as a protective substance to the protoplasm against the injurious influence of light, diminishing the amount of combustion, or, in other words, acting as a regulator of respiration.

He then proceeds to investigate what are the substances which become oxidized in the process of respiration. In every cell, without exception, that contains chlorophyll, Pringsheim finds a substance that can be extracted by immersion in dilute hydrochloric acid for from twelve to twenty-four hours, to which he gives the name *hypochlorin* or *hypochromyl*, and which he believes to be the primary product of the assimilation of the chlorophyll. It occurs in the form of minute viscid drops or masses of a semi-fluid consistency, which gradually change into long red-brown imperfectly crystalline needles. It is soluble in alcohol, ether, turpentine and benzol, but insoluble in water and in a solution of sodium chloride. It becomes gradually oxidized on exposure to an imperfectly crystalline resinous substance. It is probably an ethereal oil, and an invariable accompaniment of the coloring substance of chlorophyll, and even more universally distributed than starch or oil. It has not yet been detected in those plants which

do not contain true green chlorophyll, such as the Phycochromaceæ, Diatomaceæ, Fucaceæ and Florideæ. Starch and oil appear to be reserve substances produced by the oxidization of the hypochlorin caused by light, it being the most readily oxidizable constituent of the cell, more so even than chlorophyll itself.

That the hypochlorin—present in variable quantity in every chlorophyll grain under normal circumstances—is subject to continual increase and decrease, may be proved without difficulty. All comparative observations on chlorophyll grains in younger and in older conditions, point unmistakably to the conclusion that the collection and increase of the starch enclosed in the ground substance of the chlorophyll, goes on *pari passu* with the decrease of the hypochlorin. In dark, the hypochlorin, which does not take any direct part in transport of food materials, is more permanent than starch; and this fact again is in agreement with the conclusion that its transformation in the cell into more highly oxidized bodies is hindered by the increased respiration in light.

In the facts here detailed, and the conclusions derived from them, Dr. Pringsheim believes that an entirely new light is thrown on the cause of the well-known fact that assimilation takes place only in those cells of the plant which contain chlorophyll. This substance acts universally as a moderator of respiration by its absorptive influence on light, and hence allows the opposite phenomena of respiration and elimination of carbon dioxide to go on in those cells which contain it. A more detailed account of the experiments and results is promised by the author in a future paper.—ALFRED W. BENNETT, *in Am. Naturalist.*

PTERIS AQUILINA, VAR CAUDATA, AGAIN.—Since my note in the GAZETTE on the huge specimen of this species sent from Florida, I have received the following note from Mr. White: "In compliance with your request I measured a *Pteris* as follows: Stipe 6 ft.; first pair of divisions abortive; second pair 8 ft. from ground, and each division 5 ft. (making a spread of 10 ft., G. E. D.); third pair, spread 8 ft. and the next pair 6 ft.: total height 14½ ft. The primary divisions were 2 ft. apart until the last mentioned pair which were 1½ ft., making a spread of 6 ft. at a height of 11½ ft. from the ground. Almost aborescent, eh?"

It will be seen from this that I probably underestimated the breadth of the specimen which I described, and that the dimensions of the specimens measured by Mr. White exceed anything heretofore recorded anywhere.—GEO. E. DAVENPORT.

AMERICAN MONTHLY MICROSCOPICAL JOURNAL.—This a continuation of the *Quarterly* and is worthy the support of all interested in the work of the microscope. It is a journal of 20 pages, is illustrated, and costs but one dollar per year. The name of the editor, Romyn Hitchcock, gives an assurance of careful, conscientious work.

Botanical Gazette.

Vol. V. MAY, 1880. No. 5.

EDITORIAL.—It is proposed to make our monthly editorials a collection of odds and ends, rather than a short article upon some special subject.

The season has come when hard worked botanists are planning for a summer's campaign. One of the most profitable ways of spending the time is to attend a summer school of botany. One who has never attended such a place cannot appreciate the pleasure connected with the work there. Persons are met with whose tastes are congenial, who can appreciate a devotion to a well loved science without the usual selfish query, "What is it good for?" Fine instruments, a profusion of material, and masterly lectures, make the time pass most delightfully, and the result is a more thorough knowledge of the science of botany than can be gained by half a dozen seasons of ordinary botanical work. The expense of such a summer is exceedingly small, not being half what is so often spent in an aimless jaunting through the country. The editors of the GAZETTE have no axe to grind, but if information as to the methods or expenses in such schools is desired, we will cheerfully give it.

It was a bad slip, on the first line of p. 27, to give the width of the fruit of a *Leavenworthia* as "*two inches*," when only four lines long. The grossness of the mistake will suggest the correction of inches to lines.

A correspondent refers us to a statement on p. 24, that "all Crucifers have powdery pollen," also to the general statement of the books that wind-fertilized flowers have *dry powdery pollen*, and then wants to know why all cruciferous flowers may not be as readily wind-fertilized as *Pringlea*, and why they need to be entomophilous, since they all have powdery pollen. He should note the difference between "powdery pollen," such as that of the majority of flowers, *Cruciferæ* among the rest, and "dry powdery pollen," with light and perfectly incoherent grains, such as that of amentaceous trees, etc., which are particularly adapted to be wafted by the wind. We cannot here turn to it, but we suppose the original statement about *Pringlea* was that it was peculiar in having this *dry* powdery pollen, and thus had an adaptation for wind-fertilization correlated with the abortion of its petals. This seems to solve the riddle propounded. It may be noticed that the article on p. 12, with which all this imbroglio began, speaks merely of "powdery pollen," and therefore the writer on p. 24 rightly remarked that this was true of all Crucifers. Let us hope that at length we have come to the end of the explanation required by the unfortunate article about *Pringlea*.

NEW SPECIES OF POTAMOGETON, WITH NOTES UPON SOME PUBLISHED FORMS.—Owing to the difficulty of obtaining specimens of certain European species in fruit which are needed for comparison and safe determination, the writer has been unable hitherto to complete the promised revision of the North American species of *Potamogeton*. The following notes are published in advance in the hope that they may prove of service to collecting botanists during the coming season, and for the purpose of soliciting further specimens. The determinations of new species here offered are not regarded as final.

P. ILLINOENSIS.—Stem stout, branching towards the summit; floating leaves opposite, thick, coriaceous, oval or ovate, 2–3 inches long by 1½ broad, 19–23 nerved, rounded or sub-cordate at base, and with a short blunt point at the apex, on short petioles: submerged leaves comparatively few, dark green, oblong-elliptical, acute at each end, usually ample (the largest nearly 8 inches long and 1½ wide), entire, rarely mucronate, nearly or quite sessile, the uppermost opposite; stipules coarse, free, obtuse, strongly bicarinate, about 2 inches in length; peduncles often clustered at the summit of the stem, 2–4 inches long, usually somewhat thickening upwards; spikes about 2 inches long, densely flowered; fruit roundish obovate, 1¾–2 lines long and 1–1½ lines wide, 3-keeled on the back, the middle keel prominent and sometimes shouldered at the top, flattened and slightly impressed on the sides, obtuse or occasionally pointed at the base, the style short and nearly facial, the apex of the embryo pointing transversely inwards.

Allied to *P. lucens*, L., in habit, but with larger fruit, and in foliage quite distinct. It was first discovered by Mr. H. N. Patterson in the Mississippi River bottoms, near Oquawka, Ill. Apparently the same is also sent by Rev. E. J. Hill, collected in ditches at Englewood, Ill, but his specimens approach the *lucens* type more nearly, having very large oval, shining upper submerged leaves, which (as also the floating) are 23–38 nerved.

P. MYSTICUS.—The whole plant very slender; stems irregularly branching, from a creeping rootstock, nearly filiform, terete, 1–3 feet high; leaves all submerged, scattered, entire, oblong-linear, ½–1½ inches long and 2 or 3 lines wide, 5–7 nerved, finely undulate, obtuse or bluntly pointed at the apex, abruptly narrowing at the base, and sessile or partly clasping; stipules free, obtuse, about 6 lines long, mostly deciduous but often persistent and closely sheathing the stem; spikes few, capitate, 4–6 flowered, on erect peduncles from 1 to 2 inches in length. Fruit fully matured not seen, but one or two rather immature specimens indicate that it is obovate, minute, scarcely ¾ of a line long by ½ a line broad, obscurely 3-keeled on the back, a little beaked by the slender, recurved style.

With the habit of *P. perfoliatus*, but scarcely one-third as stout in any of its parts.—Aug., Sept. Mystic Pond, Medford, Mass., the sheet of water in which the early American investigators of this genus found so many of their plants. The author was not aware that

any one but himself had ever detected this form until he was recently shown unnamed specimens in the herbarium at Cambridge, collected a few years since by Wm. Boott, Esq., of Boston.

P. LATERALIS.—Stem filiform, branching; floating leaves elliptical, 4–6 lines long and 2 wide, with 5–7 nerves deeply impressed beneath, tapering at the base into a somewhat dilated petiole shorter than the blade; submerged leaves linear, acute, 1–3 inches in length and ¼–½ line wide, 1–3 nerved, the lateral nerves often obscure, the mid-nerve large and often with fine veins or cellular reticulations on each side, biglandular at base as in *P. pusillus*, but the glands few and small and often obsolete; stipules free, short, obtuse when young; peduncles with a very peculiar lateral appearance, (as is also the case with the floating leaves,) widely spreading at maturity, sometimes even recurved, ½–2 inches long, often thicker than the stem; spikes commonly interrupted, 2–4 flowered; fruit obliquely obovate, scarcely a line long by ¾ of a line broad, the back much curved, obtuse, with two fine grooves upon it, face slightly arched and surmounted by the nearly sessile stigma, the embryo oval in its curve, the apex nearly touching the base.

This plant has been rarely found, and specimens of it not fully developed have been referred to *P. pusillus*, with which it is allied, but Mr. C. E. Faxon discovered it the last season at Dedham, Mass., with abundant floating leaves and good fruit which seem to establish its claim to a specific rank.

P. PUSILLUS, L., var. POLYPHYLLUS.—A dwarf form, 3–5 inches high, divaricately branching from the base, and very leafy throughout; leaves very obtuse, not cuspidate, 3-nerved; non-flowering but abundantly provided with propagating buds which are formed on the thickened and hardened ends of the branches, and closely invested by imbricated leaves.

Sept.—In a shallow pool, with oozy bottom, some distance under water, at South Natick, Mass.

P. GEMMIPARUS, Robbins in herb.—Stem filiform, branching, terete, greatly varying in height, rising from 1 to 4 feet according to the depth of the water in which it grows; the internodes below, especially in deep water forms, often five inches long; leaves hair like, sometimes not as broad as the stem, often with no perceptible midrib, plane or canaliculate above, and tapering to the finest point, 1–3 inches long, biglandular at base; stipules ½–1 inch in length, acute or obtuse, mostly deciduous; spikes few, interrupted, 3–6 flowered, on long, filiform peduncles; fruit very rare, and like that of *P. pusillus*, except that it is flatter and somewhat impressed on the sides; commonly propagated by gemmæ, which are abundant. The leaves and stems are often alike in size, so that the plant seems to consist of threads, and this, with the long, naked internodes, renders its appearance very peculiar.

P. pusillus, L., var., *gemmiparus*, Robbins, in Gray's Man., Ed. 5. The mature fruit of this rare species was obtained at Amherst,

Mass., by Rev. H. G. Jesup, in 1874, and by him sent to Dr. Robbins, who thereupon substituted the name here given.

Aug., Sept. Slow moving streams and still water in various parts of New England.

P. NIAGARENSIS, Tuckerman.—Intermediate forms between this and *P. pauciflorus*, Pursh, have been found within a few years past, rendering it doubtful whether its old rank in Ed. 4, Gray's Man., as a variety of *pauciflorus*, should not be restored. The writer collected specimens in sluggish creeks and pools near the mouth of the river Niagara which have the foliage of *pauciflorus* and the fruit of *Niagarensis*. Rev. E. J. Hill has found an equally doubtful form in great abundance at South Chicago, Ill., and the same comes from Canada. A larger number of specimens, and a closer examination may make it necessary to unite the two under the older name.

P. PECTINATUS, L.—Particular attention is called to this species, as quite a number of abnormal forms have been discovered since the issue of Dr. Robbins' monograph, especially in the regions west of the Mississippi, and some of these may prove to be distinct species. It is hoped that additional specimens and notes from botanists in the field will render a good definition possible.

P. ZOSTERACEUS, Fries.—Similar in general appearance to *P. pectinatus*, but stouter; leaves flat, 1–3 inches long by 1–2½ lines broad, 3–5 nerved, with many cross veinlets, amplexicaul, obtuse or acute; stipules adnate to the base of the leaves, obtuse, shorter and narrower than the striate, scarious-margined sheaths; peduncles slender, 1–4 inches long; flowers in verticils more or less distant; fruit agreeing with that of *pectinatus* in size and shape, but rather more flattened, the style long and recurved, and the apex of the embryo pointing transversely inwards

California. *P. pectinatus*, var.? *latifolius*, Robbins in Bot. King's, Ex. 338. As figured by Reichenbach, this species has drooping peduncles 8 inches in length, with verticils of fruit 1½ inches distant, but the writer has authentic European specimens which agree with our form in every particular.

P. MARINUS, L.—Low (3–6 inches) and leafy, with many dichotomous branches; leaves all submerged, thick, setaceous, 1 nerved, with a few transverse veinlets, obtuse or acute, 2–4 inches long; stipules adnate to the base of the leaves, shorter than the sheaths which have narrow, scarious margins, sometimes white; peduncles 2–3 inches in length; spikes interrupted or in approximate verticils, fruit subglobose obovate, 1–1½ lines long and ¾ to 1 line wide, obtuse on the margins, crowned with a broad sessile stigma, the embryo circle incomplete and the apex pointing to the base, usually corrugated when dry.

The European form differs only in having peduncles 3–6 inches in length.

Aug. (*P. filiformis*, Nolte). By some good botanists reckoned as a variety of *P. pectinatus*, but the fruit is clearly distinct.

The writer found this plant a few years ago growing on moss-covered rocks, in shallow rapids at Street's Island above Niagara Falls. It doubtless occurs in other localities in this country, but has probably been confounded with *P. pectinatus*, from some forms of which it can be distinguished only by the fruit.

Apparently a new and somewhat striking variety of *P. zosteræfolius*, Schum., (*P. compressus*, Gray's Man., Ed. 5,) is sent by Rev. E. J. Hill, collected in stagnant pools at Ashtabula, Ohio. The leaves are narrower, shorter, and more acute than in the type. They are only 3-nerved, being entirely destitute of the many fine lines which are so characteristic of the leaves of this species.

Specimens of the above mentioned forms, and of other species, are respectfully solicited.—THOMAS MORONG, *Ashland, Mass.*

NOTULÆ EXIGUÆ.—Referring to Mr. Martindale's article on the germination of *Orobanche*, one may doubt if it follows from the account given that seeds do not require attachment in order to induce germination, or in order to continued growth. It is very doubtful if the seeds in this instance germinated in the pot, since last autumn. More probably they had germinated in the soil beforehand, perhaps had fed on clover-roots or on some congenial host, but had not risen above the soil, which takes place only when about to flower. In potting the Geraniums the clover may have been pulled out, but the plant, having accumulated organized material enough to complete its growth, did so in due time and occasion. It is not proved nor probable that it could have made its growth independently in the manner of a green plant.

On p. 40, last line, "Leen" probably stands for Leer's.

Miss Reynolds describes *Aster Carolinanus* as making a fine display on the Ochlawha river in Florida. Will she inform us whether the base of the long stem is suffruticose, as Walter and Michaux say.

About *Draba verna* and such plants, and whether they are to be termed biennials or annuals, a difficulty comes in, which shows how evanescent this distinction becomes. At the north, where all vegetation is for a long while arrested by winter, it is perhaps needful to consider fibrous-rooted plants which germinate late in autumn, and survive the winter to blossom and fruit in earliest spring, as biennials. But the same plants and others like them, when growing further south, and especially where the winter is moist and mild and the summer hot and dry, regularly germinate in autumn, and flower and seed in early spring. They are *winter annuals* (see Gray, Structural Botany, new ed. p. 31), plants that run their course in the cool half instead of the warm half of the year.

Pringsheim's Chlorophyll investigations, and the hypothetical conclusions drawn from them are having an unusual popularisation. It may be desirable to keep in mind that the conclusions do not follow from the premises.—A. G.

VITALITY OF THE SEEDS OF PINUS CONTORTA.—How long pine seeds retain their vitality when inclosed in the serotinous cones which sometimes occur on certain species, has probably never been very carefully noted. In 1874, Dr. Engelmann collected in Colorado a branch of *Pinus contorta*, to which were still persisting the closed cones which had ripened in 1873–72–71–70–69–68–66–65. In the spring of 1879, four years and a half after the branch had been taken from the tree, these cones were sent to the Harvard Arboretum that the vitality of the seed might be tested.

The following is the result:

All the seeds yielded by the cones were planted on the 27th of May, 1879, those of each year in a separate pot. They all received the same treatment. The final examination was made on the 13th December, 1879.

1865—18 seeds from 3 cones were planted. None germinated.
1866—No seed was obtained from the single cone of this year.
1867—No cones received for this year.

1868—24	seeds	from	2	cones	were	planted.	None	germinated.
1869—24	"	"	2	"	"	"	4	"
1870—45	"	"	2	"	"	"	4	"
1871— 6	"	"	1	"	"	"	2	"
1872—19	"	"	2	"	"	"	5	"
1873— 9	"	"	1	"	"	"	None	"

This experiment is unsatisfactory owing to the want of seeds of 1866 and 1867, and because those of 1873 had probably never been fully developed. It is only interesting in view of the fact that it may possibly lead to this subject being more fully investigated. It is particularly desirable to obtain and test the seeds from old serotinous cones of such species as *Pinus serotina*, the Florida *P. inops* var. *clausa*, *P. tuberculata*, *P. muricata*, and *P. insignis*. There are always facilities for making such experiments at the Arboretum when sufficient material can be obtained.—C. S. SARGENT, Brookline, Mass.

VEGETATION UNDER THE ELECTRIC LIGHT.—In the number of *Nature* for March 11, appears the extract of an important paper by Dr. C. W. Siemens presented to the Royal Society on March 4. The question as to whether or not the dissociation of carbon dioxide and water in the leaf cells of plants could be made to take place under artificial light as it does under sunlight, caused Dr. Siemens to undertake the experiments described. The apparatus consisted of a vertical Siemens' dynamo-machine making 1000 revolutions per minute, and driven by an Otto gas engine of 3 horse-power; furnished with a lamp with carbon electrodes of 12 and 10 mm. diameter; producing a light equal to 1,400 candles. In the first series of experiments the lamp, with metallic reflector, was placed in the open air, two meters above the glass of a sunk melon house. Pots of quick-growing plants, such as mustard, carrots, beans, cucumbers, etc., were so arranged that the light would fall on them at approximately the same angle as that of the sun, provision being made for their protection

from either when desired. The pots were divided into four groups:

1. One pot of each kept entirely in the dark.
2. One was exposed to the electric light only.
3. One was exposed to daylight only
4. One was exposed successively to day and electric light.

The electric light was supplied from 5 to 11, P. M., the plants being left in darkness the remainder of the night. The result shows what was to be expected in the first group. The second had pale, green leaves, but with sufficient vigor to survive. The third showed the usual healthy color, while the last were unmistakably superior to all the rest, both in the deeper green of the leaves and greater vigor. In these experiments the time of supplying the electric light was only about half the time of daylight. In the next series the plants were divided into three classes:

1. Exposed to daylight alone.
2. Exposed to electric light 11 hours, and kept dark in day.
3. Exposed to 11 hours of electric light and 11 hours daylight.

(1) had the usual healthy appearance at the end of four days and nights; (2) were usually lighter in color but in one case darker; (3) again were plainly superior, more so than before.

The lamp was next put into a palm-house 8 62 m. by 14.42 m. by 4.42 m. All the plants therein flourished. but those nearest the light most. No harmful effects from lack of ventilation of the compounds generated by the burning. The conclusions deduced from these experiments are as follows:

1. That the electric light is efficacious in producing chlorophyll and promoting growth.

2. That an electric center of light equal to 1,400 candles, placed at a distance of 2 meters from growing plants appeared to be equal in effect to average daylight at this season of the year.

3. That the carbonic acid and nitrogenous compounds generated in diminutive quantities in the electric arc, produce no sensible deleterious effects upon plants inclosed in the same space.

4. That plants do not require a period of rest during the 24 hours of the day, but make increased and vigorous progress if subjected during daytime to sunlight and during the night to the electric light.

5. That the radiation of heat from powerful electric arcs can be made available to counteract the effect of night frosts.

6. That while under the influence of electric light plants can bear increased stove-heat without collapsing, which is favorable to forcing by the electric light.

7. That the expense of electro-horticulture depends on the cost of mechanical energy, but can be made moderate where natural forces can be made available.

Dr. Siemens' experiments still continue and we shall await the results of longer trials with considerable curiosity. His deductions confirm those of Dr. Schuebeler on the effect of uninterruptedsunlight of the Arctic regions.—C. R B.

A NOLINA IN COLORADO.—Last January, while clipping lichens from the rocks about Trinidad, I discovered tufts of long, green, grassy leaves, which I recognized at a glance as belonging to the Mexican and sub-tropical liliaceous genus, *Nolina*. It was a fine surprise; no representative of the genus being known to occur much north of the Mexican boundary. From the winter material which I gathered, it is evident that the species is undescribed and new (*N. Greenei*, Watson, ined.). Any botanist who may wander into extreme southern Colorado, or northeastern New Mexico during the coming season is hereby notified of the presence of this interesting and imperfectly known plant; and is requested to make specimens of flowers and fruit if possible, as well as leaves. It is common up among the high, rocky verges of the mesas, along with *Yucca baccata*, all the way between the Apishapa river in Colorado, and Las Vegas in New Mexico. The leaves by which the plant is readily known, are two feet long, and much narrower than those of any of the Yuccas. —EDWARD L. GREENE, *Silver City, New Mexico.*

EARLY PLANTS.—The past winter has been so warm, that vegetation started earlier than usual this spring. It is uncommon to have plants blooming in northwestern Arkansas early in February, but this year, *Ulmus alata*, *Americana*, and *fulva* were in flower in January. *Draba brachycarpa*, *Viola cordata*, *V. tricolor*, var. *arvensis*, *Erythronium albidum*, *Ranunculus fascicularis*, *Claytonia Virginica*, *Houstonia cærulea*, *Acer rubrum*, etc., were sparingly in bloom before the close of February. A snow storm and hard freeze occurred about the 15th of March, killing the blossoms on the elms and maples, and checking the growth of everything. The elms and maples will not produce fruit this season. I succeeded in collecting blossoms of *Ulmus alata* a few days before the freeze. This species blooms so early that the flowers are usually killed before fruit is perfected. Fruit has perfected but once in the last five years. Peach trees and Japonicas put out some blossoms before the freeze in March, but were so severely shocked that the majority of the buds were delayed several weeks, and now (April 5) these species are in full bloom and the prospects most favorable for an abundant peach crop.—F. L. HARVEY. *Ark. Ind. Univ. Fayetteville, Ark.*

THE POLLEN OF PRINGLEA.—The answers of A. G. kindly given to my questions, though covering literally all I asked, do not meet all that I hoped for in connection with *Pringlea*. The original paragraph stated "all crucifers have powdery pollen. Sir Joseph Hooker thinks the plant (*Pringlea*) is anemophilous, while the rest of the order (*Cruciferæ*) is said to be entomophilous." Will A. G. add to the obligation we all feel for his instructive note, by explaining what need there is for insect aid in plants that have dry powdery pollen which can be readily taken anywhere by the wind? It had hitherto occurred to me that to have dry powdery pollen was an essential feature in an anemophilous flower. While writing may I

suggest to our friend who was so amused at "coniferous" for "cruciferous" in *Pringlea*, that he might furnish us with entertainment as well when it can be obtained out of an original article, as when an Editor is tempted to do some careless stuffing. The Editor was inundated by jokes, in the coniferous case,—but does not appear to have had one drop of fun squeezed out for him when A. G. describes the seed vessel of *Leavenworthia stylosa* as "two inches wide." We shall have to ask for a new committee on comedy if our friend so soon runs dry.—*

CRATÆGUS TOMENTOSA, L., VAR. PUNCTATA, GR.—On the east bank of Fish Creek, a few miles north of this place, there is a Hawthorn (*C. tomentosa*, var., *punctata*) which is quite as remarkable for its size as some more celebrated big trees. The thorn divides near the ground into four trunks. The largest trunk measures *fourteen* inches in diameter four feet from the ground. The other divisions are smaller, but as large as this variety usually grows, one being six inches in diameter and the others less. The tree is about 20 ft. high.

This variety of thorn is very common here, and behaves like a true species.—ERWIN F. SMITH, *Hubbardston, Mich.*

IPOMŒA PANDURATA.—The undersigned wants seeds of *Ipomœa pandurata*, capable of germination, this spring, if any one has a few on hand.—A. GRAY.

WINTER HERBORIZATIONS ON INDIAN RIVER, FLORIDA.—During January and February of the present year the writer, accompanied by Dr. J. J. Brown, spent four weeks on Indian River in studying its natural history and collecting whatever of interest offered. Our observations in that portion of Florida began at Sand Point—opposite Cape Canaveral, latitude 28 deg. 30 min., and extended to Jupiter Inlet, a distance of one hundred and fifty miles by our route. Indian River so called, is more properly a vast lagoon, being connected with the ocean by two inlets—one at Fort Capron and the other at Jupiter. The width of this inland sea varies from two to five miles except at the Indian River and Jupiter Narrows. For more than one hundred miles merely a strip of sand from one hundred yards to half a mile in width separates the lagoon from the Atlantic. This portion is largely composed of sand beaches and low flats. The eastern shore where depressed shows a dense growth of the red and black Mangrove, while further back the Cabbage Palmetto (*Sabal Palmetto*) grows solitary or in clumps. Occasionally rich hummock lands are met with where may be found a number of peculiarly southern and sub-tropical species of trees and plants. In such places trailing vines with ferns and mosses, fill up the back ground. The "Smilax" and "Wait a bit" bid you halt! The *Cereus* growing in long climbing spikes frequently obstructs the path. The small area of pine barrens and a narrow border next the ocean abound in Saw Palmetto (*Sabal*

serrulata). The surface is underlaid by "*Coquina*" throughout the whole length of the river, and this for some miles on the western shore forms bluffs twenty or thirty feet in height. The lower part of the formation is thoroughly cemented and hard. No outcroppings show a geological group older than the Post Pliocene or fossils different from living forms. The western shore stands in pleasing contrast to the eastern in its high coquina banks, back of which are extensive pine barrens. These high bluffs are replaced further south by sand ridges and hills of considerable elevation—sometimes at quite a distance from the river. A number of creeks and three rivers coming in from the west materially vary the surface geology of the country where they have broken through the natural deposits. The vegetation on this side is of the same character as that of the east shore with a few exceptions. But that tropical tree, the Mangrove, will not be found at Sand Point, neither for many miles below on the west shore, on account of occasional frosts. It grows, however, immediately opposite and southward, being protected from chilly blasts by the broad expanse of the lagoon. Species of the *Citrus* family, the banana, pine-apple, *Papaya*, *Guava*, etc., seem to attain more perfection here than elsewhere in Florida. I have never seen the black Mangrove (*Avicennia tomentosa*) grow to a greater size and height than along Jupiter Narrows. Such in brief are a few prominent features of the country as they appeared to us in our journey by sail boat and from examinations made at thirteen regular camps and a number of landings. Probably, as my friend Mr. Curtiss says, the character of vegetation and species is not so different from the St. Johns country. Familiar northern farms will frequently greet the eye, but not abundantly. The arborescent species are the most interesting as well as the most valuable, and afford a number of rare woods, such as the Crab, Boxwood, Buttonwood, Satinwood, Ironwood (several species), Gum, etc. All of these as well as the Mangrove, are capable of a high polish, and sooner or later will be utilized. My collections during the trip numbered one hundred and six species found in flower, besides some not identified. In addition I secured a number of rare wood specimens with their foliage, one of the most prized being a section of the *Quassia* tree (*Simaruba glauca*). Also alive, two Epidendrums and an Orchid found at Jupiter which is exactly the same as one from Mexico, but which no one has ever seen in Florida before. Its name is yet undetermined. Live fern roots, among them the giant *Acrostichum aureum*, have been successfully transplanted to my greenhouse in the north. I desire here to express my satisfaction in comparing notes with A. H. Curtiss, Esq., at his beautiful home, Talleyrand Place, on the St. Johns, near Jacksonville, where, with his mother, he is doing good work for botanical science, one of the results being the addition of a dozen or so of new species to the Southern Flora. Mrs. Curtiss has also enriched Algology by rare finds and new species.—W. W. CALKINS.

RECENT PUBLICATIONS.—*Revision of the Genus Pinus, and descrip-*

tion of Pinus Elliottii, by Dr. George Engelmann.—This is a folio pamphlet of about 30 pages, and contains three fine plates drawn on stone by Mr. Paulus Roetter. The author has taken hold of a perplexing genus, and with his usual patience and success, has worked it through, presenting us in this Revision the results of years of investigation. A full description is given of the structure of stem, leaves, and flowers of the genus, and then follows a new arrangement of the species with notes upon such as the author himself has examined. The position of the resin ducts in the leaves has been taken as one of the most important characters in the sub-division of the genus. This character together with that furnished by the presence and position of the hypoderm or "strengthening" cells makes the leaves a most important factor in the determination of the species, second only to the cone scales. The form of the fruit scale, together with other less important characters, constitute two natural sections of the genus, mainly STROBUS and PINASTER. The subsections are then distinguished by the position of the resin ducts in the leaf. Then comes the character of subterminal or lateral position of the female ament and the cone, making the number of leaves in a sheath quite a secondary character. This system preserves both natural and geographical alliances. The genus Pinus contains between 60 and 70 species, of which the author enumerates 45 as having been examined by himself. Two new species are described, *P. Wrightii* and *P. Elliottii*, the former being a Cuban pine, the latter growing along our southeastern coast from South Carolina to Florida, and thence westward along the gulf border, and bearing the reputation of being by far the handsomest of all the southern pines.

Ferns of North America, Parts 24–27.—With a quadruple number this magnificent work has concluded. While glad to have the completed work, we are sorry that this is the end, for we will miss the pleasurable excitement that each number brought with it and the eager haste with which the broad pages were cut, the life-like figures studied, and the clear text glanced over. This concluding number contains illustrations of *Aspidium patens*, Swz.; *Woodsia Oregana*, Eaton; *W. obtusa*, Torr.; *W. scopulina*, Eaton; *Onoclea sensibilis*, L.; *O. Struthiopteris*, Hoffman, (*Struthiopteris Germanica*, Willd.); *Pellæa aspera*, Baker; *Notholæna Parryi*, Eaton; *Cheilanthes Lindheimeri*, Hook; *Phegopteris polypodioides*, Lee; *Aspidium juglandifolium*, Kunze; *Asplenium Filix-fœmina*, Bernh.; *Adiantum tenerum*, Swz.; *Pteris longifolia*, L.; *Cheilanthes Fendleri*, Hook; *C. myriophylla*, Desv.; *C. gracillima*, Eaton; *Asplenium dentatum*, L.; *Aspidium mohrioides*, Bory, *Ceratopteris thalictroides*, Brong.; *Asplenium firmum*, Kunze; *Ophioglossum vulgatum*, L.; *O. crotalophoroides*, Walt. (*O. bulbosum*, Mx,); *O. nudicaule*, L. f.; *O. palmatum*, Plumier. The last plate is the eightieth.

Notes on the Bartram Oak, by Isaac C. Martindale.—This is a pamphlet of 24 pages giving the whole history of this much doubted species, collecting from various botanical works all the facts concerning it, many of which are very interesting. The object is to give

sufficient testimony for its re-establishment to specific rank under the name of *Q. heterophylla*, Mx.

American Agriculturist.—We can imagine no better journal than this for the class to which it addresses itself. With a competent botanist in charge of it, all readers can rely upon its scientific accuracy and freedom from scientific rubbish. The May number contains an article which ventilates pretty thoroughly a late transaction of the Department of Agriculture. If any man in the country can speak with authority upon grasses, that man is Dr. Thurber. The only wonder is that the so-called seed of "Bermuda Grass" was not submitted to Dr. Vasey, the Botanist of the Department, who could have decided the matter with equal authority.

Bulletin of the Torrey Botanical Club, March.—The table of contents is as follows: Proceedings of the Torrey Club; Notes on the Flora of Plainfield, N. J.; Notes on a Botanical Trip throngh N. W. New Jersey; Additions to U. S. Phalloidei; Correlation between the Odor of the Phalloids and their Relative Frequency; The North-Jersey Botanical Club; Botanical News; Juncus setaceus.

Kritisches Verzeichniss aller bis jetzt beschrieben Juncaceen nebst Diagnosen neuer Arten von Franz Buchenau.—Prof. Buchenau of Bremen, has published this work of 112 pages after having collected material for some 20 years. First there is given a long catalogue of species and authors, occupying 60 pages. The next 45 pages are taken up with remarks on some of the species and diagnoses of new species. The last few pages are devoted to an attempt at a natural arrangement of hitherto described *Juncaceæ*. The work will be furnished by Prof. Buchenau, postpaid to any address, for one dollar.

A Catalogue of the Forest Trees of North America, by C. S. Sargent. —This is a catalogue to be published in connection with the Report on the Forest Wealth of the United States. It is sent out in this preliminary form with every other page left blank for notes, for the purpose of collecting further information before the final publication. The list contains 342 species, and information is asked upon such points as the following: extreme geographical range of any species, regon and elevation where any species is principally multiplied and reaches its greatest perfection, the geological formation most favorable, dimensions of remarkably developed specimens of any species, common or local name, purposes for which the wood of any species is employed, products of any species other than wood.

ERRATUM.—In the first line on page 27, March, 1880, for "two inches" read two lines.

COLUMBIA COL
HERBARIUM,
NEW YORK.

Botanical Gazette.

Vol. V. JUNE, 1880. No. 6.

EDITORIAL.—LEERS, the German botanist, to whom the genus *Leersia* was dedicated, accidentally receives from the types of the GAZETTE a treatment almost as rough as the sheaths of his gramineous nam sake. His name was printed "Leen" on page 140, and the endeavor to correct it on page 53 produced "Leer's."

IN THE NOTICE OF DR. ENGELMANN'S admirable *Revision of the Genus Pinus*, we inadvertently stated that only forty-five of the species—those upon which notes are appended—had been examined by himself. An inexcusable error; for the author distinctly declares, on page 15, that he had examined every species in his enumeration.

IN MR. T. J. HOWELL'S advertisement of Oregon plants in the last GAZETTE, it was stated that he would botanize in Wyoming Territory during the coming season. It should have read Washington Territory, a correction which we hope will be noticed by all desiring to purchase western plants.

MR. A. H. CURTISS is preparing for a tour of the Florida Reefs, and afterwards expects to go into the interior of the State. We may expect some rich results.

THE DEATH OF MR. COE F. AUSTIN should have been noticed before in the GAZETTE. The announcement came with a shock to those who were only acquainted with Mr. Austin through correspondence. The GAZETTE was indebted to him for many valuable notes on Mosses and Liverworts, and such seemed to be the vigor of his intellect, the quickness of his observation, that they were by no means associated in our minds with a feeble body and failing health. He died at the age of 48, at his birthplace, Closter, N. J. His widow has put on sale his valuable collections of Musci and Hepaticæ, and it is to be hoped that botanists will promptly procure sets, "both for their own sakes and the sake of the family of this devoted scientific worker." The prices are as follows: Musci Appalachiani, $25; supplement to Musci, $6; Hepaticæ Boreali Americanæ, $15.

IN THE SAME CONNECTION we would mention the death of John Carey. He died at Blackheath, near London, March 26 ult., in the 83d year of his age. Mr. Carey contributed the articles on *Salix* and on *Carex* to the first edition of Gray's Manual.

AT NEARLY THE SAME DATE, another eminent botanist died at Paris, Wm. Ph. Schimper, whose name is so familiar to bryological students. He was in his 73d year. Twenty years of his life were devoted to the publication of what is called "a grand scientific monument," the *Bryologia Europæa*. "This contains in six quarto volumes a detailed description of all the species of Mosses known in Europe, each illustrated by a full plate of figures, beautifully and exactly re-

producing the characters of the divers parts of the plants and of their variations." Prof. Schimper's later years were devoted to the study of vegetable paleontology.

THE BOTANIC GARDEN at Cambridge is no longer a local, but a national concern. The eyes and thoughts of the botanists of this country are directed to it as naturally as are those of English, in fact the world's, botanists, to the Kew Gardens. There we find the largest herbarium, the largest library, the largest collection of living plants, indigenous to our own country, to be found anywhere on the continent. But still we can have more, and what is more to the point, we are going to have it. The present director, Prof. George L. Goodale, is a man of indomitable energy, and his heart is in this work of developing the Garden. He can keep more irons in the fire at once, and have them all hot, than any gentleman of our acquaintance. Of course improvement means money, and money is what botanists are not generally blessed with, and hence we will not make a financial appeal to them, although about $80,000 would be very acceptable. But botanists, more than any other persons, know good plants and where they can be procured, and if the botanists of this country would make it a point to send good living roots or seeds of their local rarities to Cambridge, they would be doing themselves very little inconvenience, and might do the Garden great good. The best plan would be to send to the Director a list of rare plants whose roots or seeds can be procured by the writer, and then all needless trouble would be avoided. Mr. Sereno Watson has in charge the naming of the large collection already under cultivation, and his name is a guarantee to botanists that all the labels can be depended upon.

VITALITY OF THE SEEDS OF SEROTINOUS CONES.—On page 54 Prof. Sargent gave the results of his experiments with serotinous (closed) cones of *Pinus contorta*, which I had collected in 1874 in Colorado, kept for more than four years in a garret, and sent to him in the spring of 1879. Seeds of cones 13 years old and 10 years old did not germinate; one out of six of 9 year old seeds, one out of eleven of 8 year old seeds, one out of three of 7 year old and one out of four of 6 year old seeds germinated and grew up well; those of 5 year old cones did not come up. Prof. Sargent pronounces the result to be unsatisfactory. To me it seems to be eminently satisfactory. It proved that part of the seeds from cones 5 to 9 years old had retained their vitality and that those that are older than 9 years failed; younger ones would undoubtedly have also germinated had such been experimented upon. The result shows that pine seeds of serotinous cones, or, to be more exact, seeds of *Pinus contorta*, kept under the circumstances detailed above, could and did retain their vitality a number of years—even nine years—while the perishable nature of pine seeds under ordinary circumstances is well known. The economy or the effect of keeping the cones closed is therefore evidently the preservation of the vitality of the seeds for a number of years beyond their maturity. What is not fully known and what will have to

be investigated, is how and when such seeds of serotinous cones are eventually liberated and made available, and whether not a great many of them at last perish, the cones never opening.—G. ENGELMANN.

FRAXINUS QUADRANGULATA has, at least about Allenton, in St. Louis county, Missouri, hermaphrodite flowers. Mr. G. W. Letterman finds it there common on rocky hills where it is a small tree or shrub with blunt angles of the branchlets, and in rich bottom lands, where the tree is large, and the angles of the branchlets sharp and even winged. Leaves are sometimes in threes when the branchlets show six angles. The terminal buds are gray-downy. In both localities the flowers are hermaphrodite. The calyx is practically absent, or indicated only by two obscure knobs or two minute scales, alternating with the stamens; the anthers are sessile and (before opening) reniform, their two cells being united above; stamens somewhat persistent at least to the beginning of May, when the young obovate-oblong fruits, already somewhat twisted (which twist is more marked in the mature fruit), have reached about half their full size. How does the species behave in other parts of the country? The style of *Fraxinus Americana* is very slender—much longer than the ovary; that of *F. viridis* does not much exceed the ovary.—G. ENGELMANN.

NOTULÆ EXIGUÆ.—THREE-FLOWERED BLOODROOT.—Among the anomalies occasionally met with, the most unexpected is a scape of *Sanguinaria Canadensis*, found by Mr. E. N. Wheeler, in the vicinity of Boston, bearing a pair of opposite bracts about half an inch below the terminal flower, each bract with a well-formed flower in its axil!

TRILLIUM SESSILE, as we learn from Mr. Lehman, of Salem, North Carolina, and from a specimen sent by him, abundantly occurs in the neighborhood of Kingston, Tenn., with bright yellow petals; and I have recently heard of this form from other western sources. Specimens, and especially living roots, taken up in autumn, are desired.

PERULARIA VIRESCENS is the proper name for *Habenaria* (*Perularia*) *virescens* of Gray's Manual. The examination of fresh specimens shows the "*cuculli bivalves*" of Lindley, the two lips of the base of the anther-cell which fairly cover the gland. In Florida specimens just received from Miss Reynolds, of Florida, the outer lip is the larger, or the one which principally protects the gland. How is it in the northern plant? It has long since been announced by me in Am. Jour. Sci., that *Orchis rotundifolia*, Pursh, is a true Orchis.—A. GRAY.

PLATANTHERA BRACTEATA, Torr.—This is usually regarded as a summer flowering species. In my garden, where it has bloomed for the first time this season, it is the earliest of many that I have. The first flowers were open on the 26th of April, and half of the spike had opened by the 1st of May. Hitherto *Orchis spectabilis* has been the

first to open in my gardens, but this season *Cypripedium parviflorum* will beat it. This will be open by the middle of May. My *Platanthera* was originally from Massachusetts, and being from a more northern region, required, perhaps, less heat to advance it than the same species from locations nearer home.

Mr. Wheeler, of Berlin, Mass., finds it in bloom the last week in June at Winchester, N. H., at an altitude of 1,000 feet; so that the time given in the books (July and August), even in its average locations, is probably much too late.—T. MEEHAN, *Germantown, Phil.*

DOUBLE THALICTRUM ANEMONOIDES.—Double Thalictrums are occasionally found, as many instances are on record in the literature of the past one hundred years. Those which I have seen have been white, and, as the florists would say, rather semi-double than double. I have one now in flower sent me last year by Mr Dory, of Springfield, Ohio, that is as double as it is possible to be, and of a pretty, rosy tint of white. The petals are as regularly arranged as in a first-class double Camellia. The object of this note is to encourage observers still to look for double ones; as although double ones are now not novelties, there may be novel shades of color.—T. M.

COBÆA SCANDENS.—It may be worth noting that the flowers of *Cobœa scandens*, the familiar hot-house climber, are distinctly *proterandrous*. At the time that the stamens are shedding their pollen, the trifid stigma is completely closed, nor does it open until the anthers have become functionless.—W. W. BAILEY.

NOTES ON CERTAIN SILKWEEDS.—Of the rare *Asclepias Meadii* Torr., which does not appear to have been previously detected but in Illinois and Iowa, the present writer found two nice specimens near Lancaster, Wisconsin, in flower on the 19th of June, 1879. The species differs notably from *A. obtusifolia*, Mich., with which it is grouped, in that the umbel is nodding by an abrupt bend in the upper part of the peduncle. This character is easily effaced in the process of removing the wilted specimen from damp to dry papers, and so the dry specimens may not have shown it.

The habitat of *A. Sullivantii*, Engelm., according to Dr. Gray, in the Synoptical Flor., is, "from Ohio to Kansas." But upon the wet prairies of central Minnesota it is by far more common than in any locality further north. The far western *A. speciosa*, Torr., has not been reported from farther east than Nevada, but it is frequent in the central part of Minnesota, where the eastern *A. Cornuti*, Decaisne, seems to reach its western limit. To these observations upon known species may be appended the following description of a new one:

ASCLEPIAS UNCIALIS. Stems several, only an inch or two long, decumbent; leaves from ovate to narrowly lanceolate, short-petioled or sessile, smooth and somewhat glaucous, the margins white tomentose; umbels three or four flowered, sessile; corolla dull purple; hoods broadly ovate, truncate, a little shorter than the anthers, their dimpled auricles produced into acuminate points which rest against the anthers

and nearly equal them; the broad, short, thick though somewhat flattened process representing the horn, very obtuse, or sometimes even retuse at the apex; follicles not seen.

Open hill-tops in south-western New Mexico, about Silver City, flowering in April.

In Dr. Gray's arrangement of the genus in the Syn. Fl. N. Am., this species would come next after *A brachystephana*, Engelm.—Edward Lee Greene.

Notes from Florida.—During a recent visit to Apalachicola, I had the pleasure of rambling for several miles in the vicinity of that ancient town in company with Dr. Chapman, and of being introduced by him to many plants peculiar to this region, first discovered and named by him. Of these, none interested me more than the three Myricaceae which I had not before seen; namely, the willow-like *Leitneria*, the *Myrica cerifera*, var. *intermedia*, which is much more distinct than I supposed, and the *Myrica inodora*. The latter I beheld with less pleasure than mortification, for with it I discovered a mistake in my recently issued Third Fascicle. What I distributed under that name is probably *Myrsine Floridana*. The characters presented by the shrub as found in fruit corresponded so well with those of *Myrica* that I too precipitately named it *Myrica inodora*. The latter, however is quite distinct. Dr. Chapman compared the inflorescence of *Myrsine* to a growth of *Cuscuta compacta*

Most of Dr. Chapman's field work has been done in the neighborhood of the Apalachicola river, a region which embraces wonderfully varied and interesting vegetation. Fortunately the most interesting plants were in bloom at the time of my visit, and I succeeded in preparing fine sets of over thirty species for my fourth Fascicle, including three for my second set of Ferns.

No botanist who travels southward should fail to visit the Apalachicola river. Coming here about the first of April he will find the noble *Torreya* in bloom and beneath it the *Croomia*, which at first I confounded with the young plants of *Dioscorea* and *Smilax herbacea* growing with it. Of the shrubs he will hardly know which to admire most, the yellow variety of *Azalea nudiflora*, the red *Æsculus Pavia*, or the white *Chionanthus*. He will be charmed with the *Silene Drummondii*, and stand with awe before the giant cypresses, gums and cotton woods of the river bottoms. He will be tempted to recline on deep cushions of feathery *Selaginella*, and learn to shrink from that vegetable porcupine, the *Chamaerops Hystrix*. He will marvel at the parrot-beaked *Sarracenia*, and feel repaid for his journey if he sees nothing but the wonderful *Sarracenia Drummondii*.—A. H. Curtiss, *Key West, Fla.*

Double-Staining of Vegetable Tissues.—Having used a number of dyes in double staining vegetable tissues, the conclusion I have arrived at is, that no rules can be given which will ensure success in every case. The process is quite familiar to every working micro-

scopist, but I have been somewhat surprised at the limited number who have fairly succeeded in differentiating the tissues.

In my own experience, I have met with some sections which obstinately refused to act as they should, under the operation of the two colors, but even these, with patient manipulation, can be induced to show some results, even though they may not exhibit that sharpness and purity which it is the aim and object of the mounter to obtain.

I think that a writer in *Science Gossip* has come nearer to the true laws governing the process, than any one who has written on the subject; he has, at least, indicated the direction in which the practical worker must look to attain success. My own theory differs slightly from his, and consequently my process varies somewhat, but in the main it is the same.

It seems to me that the capacity for staining tissues resides more in the colors than in the tissue itself. A stain may be permanent, unless it is driven out. It may be driven out by some solvent, by some bleaching process, or lastly by some other color. Some tissues hold the stain more tenaciously than others, probably on account of their varying density. Thus the spiral and bass-cells will retain a color longer under the influence of a solvent, than the softer and more open parenchymal cells. I endeavor to take advantage of this property, by giving the whole tissue all of one color that it can be induced to take, and then driving it out of the parenchymal tissue by a stronger color, stopping the process at the moment when the second color has completely replaced the first color in the soft tissues, and before it has begun to act upon the more dense cells. If a section be stained with roseine, and then be left long enough in a solution of Nicholson's blue, the whole section will be blue, with no visible trace of red. If it be taken out before the blue has permeated the entire tissue, the red will show, in some parts, quite clear and well-defined among the surrounding blue tissues. Following out this principle, that exact point must be determined when the blue has gone far enough.

In practice I carry out my theory as follows: I use a two-grain, neutral solution of eosin, and in this I preserve my prepared sections until I am ready to use them. They keep perfectly well in this solution, and are always ready to undergo the final process, which requires but a very short time before they can be placed, fully finished, under the covering glass. After taking them from the eosin solution, I pass them through 95 per cent alcohol, merely to wash off the superfluous color, and then place them in a half-grain solution of Nicholson's blue, made neutral. The time required in the blue solution varies with different tissues, and in the nice adjustment of this time, lies the whole success of the operation. I generally spoil three or four sections of each kind in determining the exact time required. I take a section from the eosin, holding it lightly in a pair of forceps, rinse it off rapidly in alcohol, and then immerse it in the blue, still in the forceps, while I count, "with moderate haste," ten. Then quickly place it in clean alcohol, and brush lightly with camel's hair brush. The immersion in clean alcohol seems to check the operation of the blue in-

stantly. I then examine it under a one-inch objective, to determine whether the exact point where the blue and the red remain distinct has been reached. If the blue has not occupied all the softer cells, I take another section, and put it through the same process, counting twelve, and so on, until the proper point is reached; or on the other hand, decreasing the count, if the blue has infringed upon the red in the more dense tissue. Having thus determined the count for the sections of that particular material, I pass the remainder of my sections through the blue into the alcohol, merely counting off the immersion of each section. I then place the sections for a few moments in absolute alcohol, which seems to fix the colors, then through oil of cloves into benzole, and mount in damar and benzole. It is sometimes advisable, with delicate tissues, to merely rinse off the blue in 95 per cent. alcohol and fix the colors in absolute alcohol, but every operator will learn the minor details for himself in the manipulation.

Of course, with the "rule of thumb" method of counting off the time, slight variations will occur, which will mar the beauty of the finished product; besides which minute differences in the thickness of the section will affect the result, and even a distance of a quarter of an inch in the same stem will make a difference in the density of the tissue, which will be obvious in the sharpness of the colors under the objective. So that the operator should not be disappointed if, out of a dozen slides, only four should be worth preserving. The others can go into the borax pot to be cleaned for another operation. However, the beauty of those which do pass inspection, will amply repay for the labor on the spoiled ones. I have perhaps been needlessly minute in the description of the process I have employed, but I have been so often hampered for the lack of minuteness in descriptions of processes by others, which I have been endeavoring to carry out, that I deem it better to err upon the safe side, even at the risk of being considered dry or prosy.

One word as to the use of eosin. I was attracted to it by its exquisite purity of color under transmitted light, and its perfect transparency. I found that sections preserved in its solution, always retained their transparency, and did not become clogged or thick with color, so that when taken out after months of immersion, the most dense cells were no deeper in color than the solution itself So far as regards its hold upon the tissues, it is as strong as roseine, or any of the heavier colors I have ever tried. I cannot testify as to its permanence, but I have some slides that were prepared over a year ago, that appear to be as bright and pure, as when they were mounted. Contrary to the experience of some others, I have not found that the benzole has any bleaching effect, and I have used it with damar, in preference to the usual balsam. Slides prepared with damar, however, should have a thick ring of varnish around them as the damar is brittle, and should not be trusted alone, to hold the covering glass.—W. *in American Microscopical Journal.*

Does Chlorophyll Decompose Carbonic Acid?—The recent memoirs of Pringsheim (Untersuchungen uber das Chlorophyll) sug-

gest very serious doubts as to the correctness of an inference which has crept, without the explicit consent of botanical physiologists, into the position of a fundamental doctrine of biological science. Recent articles and discussions make it desirable to examine critically, the claims which the inference alluded to has on our adhesion.

The inference in question is this, that the substance known as chlorophyll has the property of decomposing carbo nic acid so as to fix the carbon and liberate a portion of the oxygen of that acid, when in the presence of sunlight. Accordingly it has been said that "Chlorophyll is the hand wherewith the organic world lays hold of the carbon of the inorganic world" Vegetable physiologists are, however, careful not to commit themselves to such an assertion with regard to chlorophyll itself. The chlorophyll grains, or corpuscles, are particles of protoplasm impregnated with chlorophyll much in the same way as the blood corpuscles and other tissues of animals, are impregnated with hæmoglobin. It is one thing to attribute the decomposition of carbonic acid to "cells containing chlorophyll" or even to "chlorophyll corpuscles," and another thing to pass from such a wide statement to the definite ascription of the CO_2-decomposing property to the green colored substance chlorophyll.

It is perfectly true that by the method of concomitant variation, we are led to a conclusion favorable to the *importance* of chlorophyll in this function. It is only by plants (or animals) containing chlorophyll, and only in those parts of the plants containing it that CO_2 is decomposed and oxygen liberated. Further, it appears that whenever chlorophyll is present *in a living organism* (even an animal) exposed to sunlight, the decomposition of CO_2 takes place. But while we are there justified in *connecting* chlorophyll with the decomposition in question, any conclusion as to its sole efficiency, and accordingly any notion of a specific chemical activity on its part, is forbidden by two important facts: firstly, that living protoplasm is always present in intimate association with the chlorophyll when the decomposition of CO_2 is effected (forming the bulk of the chlorophyll corpuscle); and secondly, that chlorophyll extracted from the chlorophyll-corpuscle and put to the test *in the absence of protoplasm* has hitherto not been shown to possess the power of the specific decom position sometimes attributed to it.

Very usually blood red and leaf green are placed side by side as complementary, not only in color but also in function, the one active in oxidation and the special property of the animal, the other, active in deoxidation and the special property of the plant. Nevertheless, a most important fact is true of hæmoglobin which we have not ground for asserting with regard to chlorophyll, namely, that it can be extracted from the albuminoid substance with which it is associated, and then, when in a pure crystalline state can be made to exhibit its peculiar property of combining with oxygen, and again liberating that oxygen just as it does in living tissues. On the other hand the peculiar property which has been inferred for chlorophyll, namely, that of seizing the group CO from CO_2 and liberating O under the influence of sunlight, ceases altogether [as far as we know] when chlorophyll is

detached from the living protoplasm of an organism, and no effect of any kind can be produced upon CO_2 by its agency when thus isolated.

It may be urged that the chlorophyll when extracted from the chlorophyll-grain is chemically altered by the solvent (alcohol or ether) used. But the solution obtained by appropriate treatment of green leaves gives precisely the same absorption-bands as does the green substance in the plant (the whole series being moved a very little to the blue end according to the known law that absorption bands travel in that direction when a less dense solvent is substituted for a more dense one).

It cannot, however, be stated that a negative has been directly proved with regard to the supposed CO_2-decomposing property of chlorophyll. It is possible that chlorophyll when extracted by solvents from the chlorophyll corpuscles may yet be shown to possess that property. The solvents themselves may, so long as they are present, exert an inhibitory effect. Whilst ether and alcohol may do so, it is possible that vegetable fats may be more propitious, or that some other solvents may be found more closely resembling the natural solvent or the chlorophyll-corpuscle than those at present known.

Apart from the absence of sufficient evidence to warrant the assumption that chlorophyll has a specific chemical action on carbonic acid in the presence of sunlight, three facts render the supposition improbable :

1. If chlorophyll were the active agent in CO_2-decomposition, we should expect the rays absorbed by chlorophyll to be those most efficient in promoting such decomposition. Such, it has been shown by Sachs and others, is *not* the case.

2 It may well be that chlorophyll has other work to do in its relation to the specific chemical activities promoted in protoplasm by the incidence of the luminous rays. Prof. Pringsheim suggests that the true function of chlorophyll is by its general absorbent action on light to protect the protoplasm of the cell from excessive oxidation, and especially to protect that of the chlorophyll corpuscles. Oxidation being thus nearly or entirely arrested in these corpuscles, whilst proceeding in a lessened degree in the general protoplasm of the cell, the protoplasm of the chlorophyll corpuscles is at liberty *under the influence of those rays of light which are allowed to pass by the chlorophyll* (the very reverse of former suppositions on the subject) to decompose CO_2 and synthesize the elements of starch (or of hypochlorin).

3. That so special an activity as the decomposition of CO_2 and the synthesis of the elements of starch is due to protoplasm and not to the chemically simple (comparatively) chlorophyll is probable on *a priori* grounds.

If this green pigment is really something more than a screen for protoplasm, its character must be established by direct demonstration of its capabilities. The facts, as at present in evidence, look very much as though chlorophyll had been assigned a position of unmerited dignity.—E. Ray Lankester, F.R.S. *in Nature*, April 15.

Some Big Trees of Indiana.—In Case's *Botanical Index* for

April we find the following record of some large trees growing in Indiana :

Chestnut.—In Jackson county are to be found the largest chestnut trees in the State. They are veritable giants, located about three miles southeast of Seymour. One of these measures 22 feet in circumference, two feet above the ground. The height to the first limb is about 70 feet.

Sassafras.—The Sassafras attains a remarkable size on the Lower Wabash One of of these, one mile and a half west of Springfield, the old county seat of Posey, is full three feet in diameter, and for more than 60 feet, clear of limbs and knots. Its height, in full, is 85 feet.

Catalpa.—In this same region and along the Wabash, the Catalpa grows tall and slender, and in great abundance. It is used for both fence rails and posts, especially for the latter, and for durability stands next to black locust.

Sycamore.—The giant tree of Indiana in all probability, is a Sycamore in the White river bottom, not far from Worthington. It is said to be 48 feet in circumference, and has a solid trunk. At a height of 25 feet it branches into three or four limbs, one of which must be more than five feet in diameter. The tree is not quite round, but is still quite regular.

A Natural Botanic Garden.—I do not believe that any college grounds in the country, of equal extent, can surpass those of Wabash College, Indiana, in the display of native plants. A large class began active operations in the botanical laboratory as soon as the first flowers came. They have worked unremittingly ever since, some of them several hours a day ; but the grounds are far from being exhausted, even of the simpler phænogamous plants. The plants are well distributed through the families and we need no better garden for our work than the one growing without care under our feet. All the Hydrophyllums are there, and Phacelias, Scilla, three or four Trilliums, five or six species of Ranunculus, several Violets, Geraniums. Erythroniums, Isopyrum, Stylophorum, the early Composites, and so on till we could make a very respectable list of spring flowers.—J. M. C.

Some Plants of Franklin Co., Ky.—*Ptelea trifoliata*, L., is rare, but one specimen having been seen. *Rhamnus lanceolatus*, Pursh, is common along the limestone cliffs. *Polygala Senega*, L., var. *latifolia*, T. & G., is the only representative of this genus which I have met with, and it is common.

Medicago lupulina, L., is well established in many places along road sides.

Vicia Caroliniana, Walt., was met with only once in rich limestone soil.

Phaseolus diversifolius, Pers., is rare on dry hillsides.

Desmanthus brachylobus, Benth., was only found growing in cultivated grounds. Two species of *Spiræa* were met with, viz : *S.*

opulifolia, L., and *S. Aruncus*, L., both quite plentiful on the river cliffs.

A small patch of *Epilobium palustre*, L., var *lineare*, was found on the banks of the Kentucky River. *Opuntia Rafinesquii*, Engelm., grows quite abundantly on some dry hillsides. *Passiflora lutea*, L., and *P. incarnata*, L., are both found, the latter rare. *Polytænia Nuttallii*, DC., is not uncommon on rich hillsides. *Conioselinum Canadense*, T. & G., *Thaspium barbinode*, Nutt., *T. trifoliatum*, var. *atropurpureum*, T. & G., *Zizia integerrima*, DC., *Bupleurum rotundifolium*, L., *Osmorrhiza brevistylis*, DC., and *Erigenia bulbosa* are all found along the base of the cliffs in shaded situations—the latter two rare.

Symphoricarpus vulgaris, Mx., bids fair to become a troublesome shrub in pasture lands. *Lonicera flava*, Sim, is not uncommon on the cliffs of Kentucky River.

Valeriana pauciflora, Mx., is found sparingly in rich soils along the base of the cliffs.

Dipsacus sylvestris, Mill., grows along every roadside, and is becoming a troublesome weed.

Eupatorium incarnatum, Walt., (not noted by Gray this far north) grows quite plentifully on the rich Kentucky River hillsides. The flowers have the delightful odor of the cultivated Heliotrope.

Conoclinium cœlestinum, DC., is abundant in damp places. I notice that it produces subterranean runners; that the peduncles have several scattered awl shaped bracts and that the stem is minutely rosy-hued.

Aster macrophyllus, L., *A. simplex*, *Willd.*, *A. tenuifolius*, L., and *A. Novæ-Angliæ*, L., are only sparingly found.

Bellis integrifolia, Mx., is quite abundant on damp, shady hillsides. In similar situations are found *Polymnia Canadensis*, L., and *P. Uvedalia*.

Dodecatheon Meadia, L., is abundant, but I have only seen one plant with rose-colored corollas, pure white being the usual color seen here. *Bignonia caprcolata*, L., is plentiful on the cliffs, but I have never found it in flower or fruit. It retains its leaves all winter, though they change to a dull reddish color. *Conopholis Americana*, Wallroth, I found but once, and then growing certainly on *Beech* roots.—R. H. Wildberger, *Kentucky Mil. Inst.*, *Farmdale*, *Ky.*

Notes from Illinois.—Mr. H. L. Boltwood reports finding in the neighborhood of Ottawa, *Myosurus minimus*, *Anemone Caroliniana*, *Phlox bifida* and *Astragalus Plattensis*, var. *Missouriensis*.

The Acorns and their Germination.—This is the title of a paper published by Dr. Engelmann in the Transactions of the Academy of Science of St. Louis. The author was induced to pay special attention to the subject by learning that the germinating live-oak developed little tubers, well known to the negro children and greedily eaten by them. In this paper he gives the results of his study of the

acorns and oak seedlings, not only of the the live-oak but of many other species. We give the following synopsis:

In the tip of each acorn we distinguish, imbedded between the two large fleshy cotyledons, first, the little caulicle, and then at its upper end (towards the centre of the acorn) the two stalks or petioles of these cotyledons; between these the plumule is visible, more or less developed, usually only a truncate or slightly notched or emarginate knob. These parts together are in the different species and in different sized acorns usually from one to three lines long and one-half to one line in diameter; in very small acorns sometimes smaller

The acorns of all oaks germinate in or on the ground, the thickened stalks and the caulicle elongate; the former become 2 to 4 or nearly as much as 6 lines long, while the cotyledons themselves remain enclosed in the cracked seedshell, and from between the bases of the stalks the plumule grows up into the ascending axis, nourished by the food contained in the cotyledons; these become exhausted and rot away about the end of the first season, while the radicle about the same time swells up, evidently absorbing part of the matter contained in them and thus laying up a store of food for the next season.

The process in *Q. virens* is essentially the same; it differs somewhat in that the connate stalk of the cotyledons remains more slender, but elongates more, mostly to the extent of one inch or even more; the caulicle and upper part of the root swells up at once, while the developing plumule forces its way up through a slit in the base of the stalk. It seems that the danger of losing connection with the storehouse of the cotyledonous mass through the long and slender passage of the stalk, necessitates the transfer of the food-matter to a nearer and safer place of deposit. But why, it may be asked, is the connection so much longer and more slender than in other oaks? At all events it suffices, as long as it is fresh and unimpaired, to carry over in a very short time the starchy and sweet contents from the cotyledons to the tuber; and before the ascending axis is an inch high and bears as yet only a few minute bracts. the tuber is already forming and it soon reaches the size of the cotyledons themselves; it is, however, longer and more slender, of a fusiform shape, about three to four lines thick and one to two inches long, attenuated below into the long tap root.

The whole process is similar to the germination of the cucurbitaceous *Megarrhiza* of California, so beautifully illustrated by Gray in his Structural Botany; with this difference, that the cotyledons in that plant are raised above the ground while in ours they remain hypogæous, and that the stalk is even longer, and is, together with the cotyledons, readily separable into its two component parts. In both plants a tuber forms at once by the transfer of the food-matter from the cotyledons to the radicle; in the herbaceous *Megarrhiza* the tuber becomes a permanent organ of immense size, while in the arboreous live oak it is finally merged in the root.

HERBARIUM,
NEW YORK.

Botanical Gazette.

Vol. V. JULY, 1880. No. 7.

EDITORIAL.—DR. J. T. ROTHROCK left this country for Germany, June 19, to spend a few months in some of the renowned botanical laboratories there. He is specially interested in the preparation of anatomical studies and we may expect from him slides even superior to those he has already produced.

MR. S. T. FERGUS, of Westchester, Penn., is a young man who is doing some most excellent work in the preparation of slides for the microscope. We have before us a half-dozen of as handsome slides as we have ever seen. He seems to be particularly successful in the bleaching of ferns, and, by means of double staining, the spores are brought out in very sharp outline. For class use or for private study nothing better could be given than a well-selected lot of slides, such as Mr. Fergus prepares. We would cordially recommend him to botanists as one worthy their patronage.

BARON EGGERS has sent out a prospectus in which is promised the scientific exploration of the West Indies. The natural history of these islands is very imperfectly known, and what has been done gives us very scrappy results. Baron Eggers now proposes a thorough exploration of the islands for the purpose of freshening up knowledge already gained, but more for the discovery of the unknown species that he is confident are lurking there. The Baron starts in with the advantage of many years of study in the botany of the West Indies and the organization of exploration under his experienced guidance must bring very great results for very little outlay. The object of the prospectus is to invite the co-operation of botanists by subscribing for sets already made and still to be made. Subscriptions, stating the address, kind and number of collections desired, should be sent to Baron Eggers, St. Thomas, West Indies, by the 1st of July. Payment will be made upon the delivery of the collections. The price per hundred species for Phænogams is $12 50; for Cryptogams, $10. If botanists desire, arrangements can be made to send only their *desiderata*.

THE VALLEY NATURALIST comes to the front again, and through a circular letter promises to revive itself, under a somewhat altered form, for $1.50 per year. It is to be published monthly and will consist of sixteen pages, and appeals to naturalists of every kind for a support. It calls for the "minor notes that every working naturalist daily makes, and however interesting they may be, often remain forever buried in the note-book of the observer." Now, we have been fishing for these same "minor notes" for some years past, and

have come to the conclusion that botanists do not take as many notes as we give them credit for doing, or that such notes as they do "daily" make are not worth publishing in any kind of a paper, and if they are buried they deserve to be. We are only afraid that if Mr. Skaer confides too much in the resurrection of buried notes he will find 16 pages hanging heavy on his hands. Too often does the scientific editor, when the time to go to press comes to hand, find himself compelled to make something out of nothing, and his many subscribers, with their many buried notes, sit quietly down and read the result with no pangs of remorse. Any one sending 15 cents to Mr. Henry Skaer, Room 34, N. W. Cor. 3d and Pine Sts., St. Louis, Mo., can obtain No. 1 of the *Valley Naturalist*, and can judge for himself whether he wishes to continue it.

Mr. E. S. Miller, of Wading River, N. Y., sends out for 1880 an attractive catalogue of North American Orchids, Bulbs, Aquatics, Ferns, etc. The promise is made that any North American plants, not in the catalogue, will be procured if appplication for them is made in suitable season. The list as given contains 56 Orchids, 76 Ferns, 54 Aquatic plants, 76 Bulbs, 28 Shrubs, and 193 Herbaceous Plants.

Dr. Otto Kuntze, of Leipzig, has recently published a work in which he seems to take some very advanced views and proposes some very radical changes. He considers that recent investigations, such as those of Darwin, have destroyed the old idea of species, but that we still hold to it in systematic botany. He makes strong objection to the practice of taking some form as the type of a species and thus seeming to acknowledge species as a fixed rather than a relative thing. To follow nature correctly he contends that every form should be described and arranged in proper relationships, and thus the true genealogy might be made out. Dr. Kuntze illustrates his methods by applying them to the simple-leaved forms of the genus *Rubus*, a most perplexing one to Old World botanists. Thus, if we catch the idea, under this genus *Rubus*, we would have no specific names, but simply terms applying to certain classes of forms. Not so very simply, either, as the following proposed names will show. Under simple-leaved *Rubi* are first, *Finiformes* and *Gregiformes*. The latter are again divided into *Locoformes*, *Typiformes*, *Versiformes*, *Ramiformes*, *Avoformes*, *Medioformes*, *Mistoformes*, *Singuliformes*, etc. Rather than use such terms in place of our simple specific names we think that botanists will choose to continue to seem to contradict nature for the sake of convenience. We can still say *Rubus Canadensis* with the mental reservation at the same time that we know there is no such thing, just as we speak of the flow of a current of electricity, although we know that electricity is no fluid. Nor do we see why the proposed change should not be applied to genera as well as to species. Another change Dr. Kuntze proposes is to use arbitrary signs in place of language in botanical descriptions. Imagine the descriptive phrase, "Sepals 2, ovate, free, persistent. Stamens 5, adhering to the short claws of the petals" made to look someting like this—"S_2 x o=A_5 x X y P." When a botanical description gets to

look like an equation in affected quadratics it loses much of its attractiveness to the ordinary botanist.

THE EDITORS OF THE GAZETTE propose to take a summer vacation, and to be relieved for a month or two from editorial duties. The August number will, therefore, not be published as usual, during the last week of July, but publication will be deferred to the last week of August, when a double number, of at least 30 pages. will be published for August and September. Any communications sent during the months of July and August should be addressed to the Editors at the Botanic Garden, Cambridge, Mass. We hope that subscribers will take careful note of the above, and not be sending us queries as to what has become of the August GAZETTE.

NOTULÆ EXIGUÆ.—*Eremurus robustus*, that stately Liliaceous plant of Turkestan, which is now displaying its raceme of half a yard in length in the Cambridge Botanic Garden, exhibits strong proterandry correlated with a movement of the style, analogous to that of *Sabbatia*. When the flower opens the slender style becomes at once strongly deflexed ; on the second or third day, when the stigma becomes receptive and the anthers effete, the style straightens and brings itself nearly into the line of the axis of the flower.

The collection of Venezuelan Mosses put up into sets of 145 species each, named by Dr. Mueller, with a printed form of ticket, along with a copy of the pamphlet (from Linnæa) in which they are enumerated. and the very many new species described, is now furnished for $14, by Adolf Schrader, No. 224 West State St., Columbus, Ohio.—A. GRAY.

VITALITY OF SEROTINOUS CONES.—In a seed so large as any one of the Pines referred to, there need be no prolonged experiment to ascertain its vital power. All seeds change the normal color when the germinating power is lost. If a pine seed has an ivory white tint when cut across, it may grow, no matter how many years old it may be. I say may grow, because there are many contingencies on which success is dependent besides the vital conditions of the seeds themselves. Germinating pine seeds are susceptible to fungoid attacks beyond any seeds I know, and they are very often wholly destroyed before the radicle has hardly pushed through the seed coat. In Prof. Sargent's experiments the seed were sown on the 17th of May, and "the final examination was made on the 15th of December." The final examination should have been made within six weeks of sowing, as in *Pinus contorta*, all would have been sprouted in that time that intended to grow, and those with injured radicles would have been distinctly seen.

As the original discoverer of living trees of *Pinus pungens* in Pennsylvania (an old cone having been found by Professor Porter a few months before) I have taken an interest in watching its behavior. The cones would scarcely be called serotinous as a general thing, for I have often found cones of the same season open in October, and all

the seeds dispersed. But cones of many years old can be found on many trees, and though some have no seeds, others are full, and by cutting them across the seeds are found perfectly good. For commercial purposes when the new cones are not abundant enough, old cones are gathered for the seeds, and they grow just as well as the recently matured ones. I have known *Pinus pungens* six years cleaned to grow just as well as those taken from the cones, —and these cleaned seeds, too, made up from old closed cones, as well as from the fresher ones.

I have often been tempted to take up the pen, when scientific experiments have been recorded on the growth of seeds. Many of them are fallacious from assuming that seeds fail to grow to young plants for no other reason than that the seeds had lost their vital power. One may take a hundred of the freshest kind of Pine seeds, and another hundred of the same kind and sow in separate pots, and keep both under exactly the same conditions as far as he knows, and yet from the hidden causes I have referred to, have one hundred plants from one pot, and not fifty from the other. I feel quite sure that a serotinous Pine seed, if white and not yellowish when cut across, would grow just as well when twenty years old as any from recent cones.—T. M.

Michigan Lake Shore Plants.—The following is a partial list of plants growing on the beach and sand banks of Lake Michigan in the vicinity of South Haven, Mich.:

Geranium Robertianum, L., grows sparingly on shady bluffs. *Ptelea trifoliata*, L., grows quite thriftily in clean white sand. *Arabis hirsuta*, Scop., is found on banks with heavy soil, and *A. lyrata*, L. abundantly in pure sand. The lyrate-pinnatifid radical leaves of *A. lyrata* are generally entirely covered by the drifting sand, causing them soon to decay, thus making the plant difficult of analysis. The uppermost leaves are perfectly linear, and the whole plant often glaucous.

Prunus Virginiana L., *P. Pennsylvanica*, L, and *P pumila*, L., are all found on sandy banks, the latter often ascending to a height of over four feet. *Potentilla Anserina*, L., grows on the level beach, its clumps of beautiful pinnate leaves, strongly resembling, at a short distance, a tuft of ferns. *Crataegus tomentosa*, L., var. *pyrifolia* occurs occasionally. *Lathyrus maritimus*, Bigelow, is plentiful in the sands all along the beach, making a fine display.

Diervilla trifida, Moench., occurs sparingly in the sand. *Cirsium Pitcheri*, Torr. and Gr., grows on sand bluffs. It is a singular plant, its very heavy heads resting on the ground.

Pyrola chlorantha, Swartz., *P. secunda*, L., and *Chimaphila umbellata*, Nutt., occur on shaded bluffs. *Arctostaphylos Uva-ursi*, Spreng., I found on exposed, sandy banks.

Polygonum cilinode, Mx., is abundant in drifting sand. *Euphorbia polygonifolia*, L., is found on the level beach, also *Corispermum hyssopifolium*, L., but sparingly.

Lithospermum hirtum, Lehm., is abundant on sand bluffs. Its showy yellow flowers are very fragrant. It might be a valuable acquisition to our gardens. *Shepherdia Canadensis*, Nutt., is abundant. *Salix viminalis*, L., occurs abundantly on a springy, clay bank near the harbor. *S. discolor*, Muhl., and *S. rostrata*, Rich., grow to a good size in clean sand. *Populus balsamifera*. L., var. *candicans* is native north of the harbor. This clump of low, stunted trees, is the remnant of a narrow belt about a mile in length which contained scattering specimens when the first settlements were made here thirty years ago.

Juniperus communis, L., and *J. Virginiana*, L., are common; and in the bluffs under evergreens, *Thuja occidentalis*, L., and *Taxus baccata* L., var. *Canadensis*, Gray.

Juncus Balticus, Willd., is abundant on the beach. *Calamagrostis longifolia*, Hook., and *Cenchrus tribuloides*, L., are uncommon. *Aspidium marginale*, Swartz., occurs on the bluffs. Specimens of most of the above are on hand for exchanges.—L. H. Bailey, jr., *South Haven, Mich.*

Fungi on Anemone nemorosa.—I have found on living plants of *Anemone nemorosa*; *Synchitrium Anemones*, *Æcidium Anemones*, *Æ. Ranunculacearum*, *Puccinia Anemones*, *Peronospora pygmæa*, and *Urocystes pompholigodes*. I have sometimes found three of these on the same leaf. Is there any other plant that has an equal number of parasitic fungi?—E. W. H., *Decorah, Iowa.*

La Phytographie, by Alph. DeCandolle, 8 vo., 48 pp.—This is a work we would like to see translated into English for the benefit of our own botanists. Coming as it does from the most eminent European authority, from one whose whole life has been devoted to the description of plants, it is likely to become the authority upon Phytography, or the art of describing plants considered from almost every point of view. At first sight the subject appears to have to do with the form of botanical works alone, but the art of describing is based on that of observing, comparing and classifying. Phytography with respect to facts is a sort of garment, which it is necessary to know how to modify to suit the dimensions of an individual increasing in stature. Two old works have exerted a powerful influence on botanical writings, namely, the *Philosophia botanica* of Linnæus, and the *Theorie elementaire de la botanique* of Augustine Pyramus DeCandolle. These works are separated from each other by more than sixty years, and now, again, after the lapse of more than sixty years, Alph. DeCandolle publishes this present work, in which are considered many questions that the progress of the science has suggested. The direction of the *Prodromus* and of the *Monographiæ Phanerogamarum* has peculiarly fitted the author for the work in hand, and he can speak upon this subject from a wider experience, probably, than any other botanist. The great prominence the author gives to works on descriptive botany, he says, is due to their neces-

sary duration. Works upon every other branch of botany are comparatively short-lived, being compelled to be re-written with every advance in knowledge. He refers to works on vegetable physiology and anatomy and says that the authors of even a few years ago are forgotten and their works consigned to obscure corners in botanical libraries. In vegetable physiology Hales and DeSaussure are rescued from their oblivion. In vegetable anatomy every improvement of the microscope has compelled much of the work to be done afresh. That which we describe by unaided vision always remains, but that which we see with the aid of processes of amplification must depend upon the nature of these processes, and some simple discovery of an optician may cause the abandonment of many excellent books. Descriptions of plants, however, are most enduring, and works containing them always will be consulted. Such books of even a century old or more are being constantly consulted, for the law of priority demands a great deal of hunting back in dusty records, where verification, if anywhere, demands clear description. Since the duration of descriptions is so great it is important that they should be well done. The anatomist and physiologist are fortunate enough to be able to fall into oblivion, but for the describer of forms and groups is reserved a much more serious fate. Like the Wandering Jew, he is condemned to live, and being of necessity consulted, if his work is badly done, he is open to the execrations of botanists century after century. The author then gives an exhortation which should be hung in illuminated text over the work-table of every botanist who attempts to describe a species: "Observe with care, describe with method, name and classify properly; your reputation, even your honor is at stake." Works on natural groups of plants are destined to absorb and summarize all other departments, for into the description of species, genera, families, etc., must enter, sooner or later, the anatomical characters, the physiological properties, the facts of habitation, origin, bibliography, etc. The author is disposed to think that we, in schools, are in danger of running too much, to anatomical dissections, avoiding the older paths of classification, and we do not know but that he is right. It can hardly be questioned that the mind is called into higher and more general action by the study of the basis of classification than by studying how to dissect and hunting for the thousandth part of a millimetre under a microscope. As De Candolle says, the former is a more efficient method of training for a general student, by teaching him observation, and the best means of observation is acurate description. The names of the species, the groups, the organs may all be forgotten, but the principles are not, and the same methods can be well applied in may other things.

The object of the present volume is the perfection of the methods of the description. There is a loud call for greater uniformity in all departments of natural history. There is no reason why the terms used in Phaenogamic and Cryptogamic botany should be so distinct that an adept in one may not understand the language of the other. There should be fixity in the names of organs, and in works on

anatomy there should be regular methods of description, such as have been so successfully employed in systematic botany. The progress of botany now, as of all sciences, is towards simplicity, as for instance, all the parts of plants, the most complicated, are reduced to root, stem, and leaves, and these in turn are but multiplied cells, proceeding from a plasma of uniform appearance. So methods of description should be reduced to like simplicity and comprehensiveness.

The author hopes that the progress of the science and in a very small degree the application of his own counsels may render useless in a few years the great part of the present volume. The last part of it, however, will be long consulted, for it is a grand list of herbariums that are of use in authenticating species. From this list can be learned just where at present are the herbariums of authors who have published and the famous collections of explorers. For this botanists will be very grateful for it will help in securing information that might not otherwise have been obtained.

ALBINO ARETHUSA BULBOSA.—Mr. Fred Hoard, of Providence, R. I., has just brought me a perfect albino of *Arethusa bulbosa*, L. The yellow lines of the labellum are retained.—W. W. BAILEY.

RECENT PUBLICATIONS.—*Catalogue of North American Musci.* Eugene A. Rau and A. B. Harvey. This neat catalogue of over fifty pages is intended to furnish a check and exchange list, and also a basis for the arrangement of genera, etc., in herbaria. It undoubtedly supplies a want felt by many botanists, and will be received with thankfulness The range is a large one. including all North America, every authentic species reported from Mexico to the Arctic region, appearing in the list. Of course, the species are all numbered to facilitate exchanges, and the numbers mount up pretty well, rising to 1,252, distributed among 177 genera.

Catalogue of Trees and Shrubs, native and introduced in the Horticultural Gardens adjacent to Horticultural Hall, Fairmount Park, Philadelphia. This catalogue contains a hundred pages and is a good one but no man's name appears as author and we will have to take it as an anonymous production. The catalogue seems to be made more for the convenience of gardeners and amateur botanists, than for professional botanists. A great deal of work has been done in the matter of synonyms and brief descriptions in the hope that the species may be recognized Both genera and species are arranged in alphabetical order, and as the author acknowledges his sin in this matter, his reasons seem to be very good. It is a capital catalogue and does just what it professes to do, and we can imagine nothing more convenient in the hands of a botanist visting Fairmount Park, or one desiring to know what was under cultivation there.

Bulletin of the Torrey Botanical Club, May.—The noticeable feature in this number is Mr. Davenport's description of a new fern accompanied by an excellent plate, drawn by Mr. C. E. Faxon. The new fern is *Notholæna Grayi*, and was collected among the mountains

of south-eastern Arizona, by Wm. M. Courtis. Mr. Davenport considers it one of the most elegant species yet discovered and so different from any known form that, although the material is scanty, he has no doubt as to its claim to rank as a genuine species. "There is no other species with which it can be compared. Under the microscope, the white powder (upon the fronds) separates into distinctly stalked gland like bodies with enlarged conical, flat or inverted heads like a miniature host of fungi, with their variously shaped caps. With a power of 200 diameters, or even less, the scales of the frond appear to be composed of elongated, cylindrical, tapering tubes, containing a light brown coloring matter, collected into a mass at the base, or in spots at intervals throughout the length of the otherwise whitish scales, which are thus made to appear jointed."

American Naturalist, June.—This journal, of course, runs to Zoology, as is to be expected from the tastes of both its editors. Every department has a specialist in charge of it except botany, and, of course, the botanical notes lose just that much in force and authority. But the wants of botanists have not been entirely neglected, and we have to thank the *Naturalist* this year for several valuable articles. The most interesting one in the June number is Prof. C. E. Bessey's on "The Supposed Dimorphism of Lithospermum longiflorum." The author seems to have made a most exhaustive study of this species, carefully measuring the length of corolla tube, the height of anthers and the height of stigma of over 60 flowers, with the view of testing the supposed dimorphism. The results show great variation in the measurements, but nothing like the well-marked differences that appear in true dimorphism, such as that of the nearly allied *L. canescens*. The results are summed up as follows:

1st. The length of the corolla is exceedingly variable.

2d. The distance from the anthers to the top of the corolla tube is approximately uniform, so that the position of the anthers is largely dependent upon the length of the corolla tube.

3d. The length of the style is even more variable than that of the corolla tube.

Mr. E. Greene writes that in his article on "Certain Silkweeds" in the last Gazette, it should read of *A. Sullivantii* that it is more common in Minnesota than in other locality further south, rather than "north," as it is printed. Also *A. speciosa* has not been reported farther east than Nebraska, instead of "Nevada."

Hygienic and Therapeutic Relations of House Plants, by J. M. Anders, M. D., Ph. D.—This small pamphlet of sixteen pages is a reprint from the Philadelphia *Medical Times*. It will be remembered that Dr. Anders last year published in the *American Naturalist* some articles in which were recorded some very careful observations with regard to the moisture evaporated by plants and their beneficial influences, The present paper is meant as an answer to the common question, "How do plants in rooms affect the health of the inmates?"

We make no apology for making some extracts from a paper which deals with a subject of universal interest:

"The old question of the effects of living plants on the air of houses is one of considerable interest. The family doctor is often confronted with the query, "How do plants in rooms affect the health of the inmates?" Formerly, it was the universal opinion that they were injurious to health, particularly in the sleeping room and sick-chamber. Unfortunately, this still continues to be a popular impression. To review the various views on this topic, down to the present, would be foreign to the scope of this article and quite out of place. The discussion will necessarily be confined to the present state of our knowledge concerning this subject, and especially such of its bearings as are interesting from a medical point of view.

"Three of the chief functions in plant life are the absorption of carbonic acid, the exhalation of oxygen, the generation of ozone. Now, it has been conclusively shown that variations in the amount of these gases from the presence of any number of plants have no appreciable effect on the air of an apartment, the absorption and exhalation of these substances being carried on too slowly either to improve or to vitiate the air.

There is, however, yet another process in plants, which in this connection is of far greater importance, viz., that of *transpiration*. By this term is meant the exhalation of moisture by the leaves. About this function very little was known until recently. Careful investigations of the subject have been made by the writer to which brief reference only can be made here, for they have formed the basis of a paper elsewhere It may suffice to say that the average rate of transpiration for plants having soft, thin leaves, as the geranium, lantana, etc., is one and half ounces (by weight) of watery vapor per square foot of leaf surface for twelve diurnal hours of clear weather. In order to convey some notion of the great activity of this function, it might be stated that at the above rate the Washington elm, at Cambridge, Massachusetts, with its two hundred thousand square feet of leaf surface, would give off seven and three quarter tons of water in twelve hours. In the twenty-four hours an in door plant will transpire more than half as much as one in the open air. It would appear to follow naturally from these facts that growing plants would be capable of raising the proportion of aqueous vapor of the air of closed apartments. And this suggestion prompted the writer to make observations with the view of establishing this fact experimentally. By means of the hydrometer, the atmosphere of two rooms at the Episcopal Hospital, in which the conditions and dimensions were in every respect similar, were tested simultaneously, in order to note the variations produced by growing plants. In the window of one of the rooms were situated five thrifty plants, the other contained none.

For eighteen consecutive days the dew-point of the room containing plants gave an average complement one and a half degrees lower than the room in which there were no plants. Thinking that

possibly this difference of humidity might not be owing solely to the presence of plants, the conditions were varied, and further observations made, with similar results. The manner in which these investigations were carried out cannot be here detailed. The following conclusion should, however, be quoted: "During the summer months, when the windows are thrown widely open and the doors kept ajar, the influence of transpiration is quite inconsiderable; on the other hand, when the interchange of air is not too rapid, a sufficient number of plants, well watered, have the effect (if the air be not already saturated) of increasing the amount of moisture to a considerable extent." This point, as will be presently seen, is of special importance where houses are heated by dry air furnaces."

Then follows the record of a number of cases, from which the following conclusions are drawn:

"From the above cases it will be seen that what we had deduced from experimental results concerning the health giving effects of plants (which is owing to transpiration increasing the humidity of the air,—the plants acting as natural and perfect "atomizers") is entirely in harmony with what is observed concerning the effect of sufficiently moist warm air in many cases of phthisis, and if it is true, as we have attempted to demonstrate, that house-plant hygiene constitutes a valuable preventative measure where there is hereditary tendency to certain diseases, then it ought to be definitely and thoroughly understood, and it is of vital importance that it should be adopted in cases where there is known predisposition to phthisis, for half of the cases are supposed to be preventable, whereas if the disease be allowed to develop, complete recovery is not to be expected. Furthermore, though the keeping of plants does not "cure" confirmed cases of phthisis, it is nevertheless very useful to prolong life, and by ameliorating the distressing symptoms renders existence at least endurable—an office not to be despised in such a wide-spread and lingering disease.

Observation teaches that advanced cases of phthisis (as, for instance, where cavities exist) are benefitted by a more decidedly moist atmosphere than is required in health, and hence they will require a much greater profusion of plants in the room than those who have the disease in a more incipient stage.

The plants should be well selected and kept in a thriving condition. The chief points to be borne in mind in the selection of the plants are, first, that they have soft, thin leaves; secondly, foliage-plants or those having extensive leaf-surface are to be preferred; thirdly, those which are highly scented (as the tuberose, etc.) should be avoided, because they often give rise to headache and other unpleasant symptoms.

In order to facilitate a practical application of the data gained by experiment, the following formula has been carefully prepared: Given a room twenty feet long, twelve feet wide, and ceiling twelve feet high, warmed by dry air, a dozen thrifty plants with soft, thin leaves and a leaf-surface of six square feet each would, if well

watered, and so situated as to receive the sun (preferably the morning sun) for at least several hours, raise the proportion of aqueous vapor to about the health standard

This formula may serve as a guide in the use of plants for hygienic purposes; but under conditions of actual disease it will be necessary to increase the proportion of plants according to the degree of humidity sought, or as the indications of individual cases may demand.

It should be stated that, to obtain the best results, both the rooms occupied during the day and the sleeping apartment should contain plants. It was for a long time the opinion of scientific interpreters generally that plants in sleeping apartments were unwholesome because of their giving off carbonic acid gas at night; but it has been shown by experiment that it would require twenty thrifty plants to produce an amount of the gas equivalent to that exhaled by one baby-sleeper: so this is no valid objection to their admission, and not to be compared with the benefit arising from their presence.

We have no desire to underrate other means of treatment while upholding the importance of our subject. Exercise in the open air is of immense advantage in phthisis, and during the warm season the consumptive should be moving among his garden-plants, and, if he be a lover of flowers, should assume personal charge of them. Again, no one will dispute the value of certain tropical climates for judiciously selected cases of phthisis; but the practice of indiscriminately sending patients to them is certainly to be deprecated.

New health-resorts (many of them comparable only to the patent nostrums) are constantly being pressed upon the public, but too often a trial of them brings only disappointment, and the consumptive is rendered more miserable by the annoyance of travel and the anxiety of being separated from all the endearing relations of home. And even where travel is desirable, it is, for financial or other reasons, quite impossible in a large proportion of cases.

To have always at hand and readily available so complete and withal so agreeable a health-resort at home as that furnished by a room well stocked with plants must prove an inestimable boom to the despairing invalid.

The Origin and Survival of the Types of Flowers.—In a lecture delivered before the California Academy of Sciences, October, 1879, Prof. Cope proposed the hypothesis that "the consciousness of plant-using animals, as insects, has played a most important part in modifying the structure of the organs of fructification in the vegetable kingdom. Certain it is that insects have been effective agents in the preservation of certain forms of plants." Dr. Hermann Mueller has recently published a book in which he seeks to explain the existing variations in the forms of flowers on the principle of selection. He supposes that insects of different tastes bred peculiar flowers, just as men breed peculiar races of cattle. Carrion loving insects bred their kind of flowers, and long-tongued insects, the tubular kinds, and

many other classes of insects have, each class, bred the flowers they love best.

Dr. Mueller is abundantly able to theorize on this subject, and his views, so far as they go, will command the assent of most persons. But like all the Darwinians, he confounds survival or preservation of characters, with the origin of characters. On this subject Prof. Cope has the following: "I would suggest whether the mutilations and strains they [plant-using animals] have for long periods inflicted on the flowering organs may not, as in some similar cases in the animal kingdom, have *originated* peculiarities in structure."—*American Naturalist.*

SOUTH-WESTERN PLANTS.—Prof. F. L. Harvey, of Fayetteville, Ark., has sent a list of plants that were collected upon a recent trip from Fayetteville to Neosho, Missouri. The list numbers about 120 species, most of them such as are common farther north and east. Of course, introduced species go wherever man goes, and such may be expected to appear in every list of plants, and the interest attached to them comes chiefly from the fact that they are spreading just as was expected. Species peculiar to any region often are unexpected species, and hence a list of indigenous plants is always interesting to look over. We have no space, of course, to reproduce Prof. Harvey's complete list, for bare lists make dry reading at best, unless the reader is looking for exchanges. The mention of a few species, however, may be interesting. We note the following: Isopyrum biternatum, Corydalis crystallina, Arabis Ludoviciana, Scleria aurea, Viola tricolor, var. arvensis, Arenaria Pitcheri, Lathyrus pusillus, Astragalus distortus, A. Mexicanus, Zizia integerrima, Fedia radiata, F. longiflora, Androsace occidentalis, Collinsia violacea, Pentstemon tubiflorus, Amsonia Tabernæmontana, Trillium sessile, var. Nuttallii, Ranunculus sceleratus, Corydalis aurea, var. micrantha, Heuchera villosa.

NARCISSUS CANARIENSIS.—E. H. Krelage and Son, Nurserymen, of Haarlem, (Holland) send out a circular advertising the above species for sale. The circular consists principally of a description of the species taken from a work entitled "The Narcissus; its history and culture." It is the smallest flowered form in the whole group, the dried flowers being half an inch across. It is not in cultivation yet, the Royal Herbarium, Kew, containing but a solitary dried specimen. In the month of June the above firm received a consignment of bulbs and will fill orders that are immediately sent to them. As the plant is exceedingly scarce, even where it is found, it is hardly probable another opportunity of securing bulbs will be offered.

Botanical Gazette.

Vol. V. AUGUST AND SEPTEMBER, 1880. Nos. 8 & 9.

EDITORIAL.—DR. ASA GRAY sailed for Europe September 4th, to be absent a year or two. His head quarters will be Kew Gardens, but he will probably visit several of the large herbaria upon the continent This trip is in connection with Dr. Gray's work upon the Synoptical Flora of North America. It is to be hoped that this crowning work of a long botanical life will be speedily completed, although the author has met with very little financial encouragement thus far. To be poorly patronized seems to be the necessary accompaniment of very great works, for they are necessarily expensive. The Synoptical Flora, though, should be in the hands of every North American botanist, especially those to whom the author has uniformly given a kind hearing and prompt response. A note to Dr. Goodale or Sereno Watson at Cambridge would probably elicit all desired information as to price.

A LARGE COLLECTION of the products of Indian plants has just been received at the Botanic Gardens, Cambridge, from Kew. The collection is a part of what was put up in India for the Vienna Exhibition and is very rich in its representation of Indian drugs, foodstuffs and vegetable products used in the arts and manufactures. For illustrating lectures upon economic botany it is very complete, as there are representatives of useful products from nearly every family. The University of Wisconsin, Purdue University, and Wabash College, Ind., are under very great obligations to the Director of the Botanic Gardens for very complete duplicate collections.

IN THE JULY NUMBER of the GAZETTE we announced the proposed exploration of the botany of the West Indies, under the direction of Baron Eggers, of St. Thomas. We should add that the particular aim of this exploration will be to make known the botany of the great islands of Hayti, Dominica, and Porto Rico, of which very little is really known, and that little is of ancient date, and little accessible. Also, that it is intended to have the plants arranged and studied by high authorities, and generally named before distribution. It having been suggested that the price for phaenogamous plants, announced at $12.50 the century, is rather high, we understand that it is intended to bring it down to the usual ten dollars the hundred specimens. But in this case a good number of subscribers should be secured.

DR. DODEL-PORT, of Zurich, has published the first two parts of a new botanical work. The title is "Illustrirtes Pflanzenleben." The

first part is devoted to a popular description of the lower fungi, such as those which produce putrefaction and contagion. Part second is devoted to carnivorous plants. The whole work is profusely illustrated.

EUCALYPTOGRAPHIA is the title of a descriptive atlas of the Eucalypts of Australia and the adjoining islands, by Baron F. von Mueller. At present there have been published but two decades of the work. This group of trees seems to be a most remarkable one in size and in value. The genus *Eucalyptus* is a very large one, and by no means have all the forms been described. The Eucalypts, as they are called, are said to yield hard timber, oils, tars, acids, dyes, tan, and potash. Some of them rise to a height of 300 feet, with a stem six feet in diameter, and sometimes ten. Packing paper has been prepared from the inner layers of the bark. One species, *E. alpina*, is remarkable for its limited geographical range, being found only on the summit of Mt. Williams, Victoria, at an elevation of over 4,000 feet.

The agents for this work in London are Messrs. Trubner & Co.

EVOLUTION OF THE VEGETABLE KINGDOM, by Dr. Adolf Engler. Part I of this work is noticed in *Nature*, from which we take the following synopsis of contents: "The subject, 'The Extratropical Region of the Northern Hemisphere,' is divided into five sections. In the first section the author treats of the development of the flora of North America from the Miocene period to the Glacial epoch; the second is devoted to the development of the flora of Eastern and Central Asia since Tertiary times; the third to the main features of the development of the Mediterranean flora since the Tertiary period; the fourth to the development of high mountain flora before, during, and after the Glacial epoch; and the fifth to the consideration of the development of the floras of other countries influenced by the Glacial periods."

A NEW ENGLISH TEXT-BOOK OF BOTANY has been translated from the German of Prof. K. Prantl and revised by S. H. Vines. The object of this work is to provide a more elementary text book than Sachs, but, at the same time, to follow his method of treatment. It seems to be principally made up of Sachs simplified, and in spite of some minor blemishes the reviewer in *Nature* pronounces it emphatically to be the best of its kind in the English language.

THE ROYAL GARDENS, KEW, have been lately receiving some valuable gifts. The herbarium of Dr. Goodenough, who died in 1827, has been transferred to the Gardens and the great collection of mosses accumulated by the late Prof. Schimper, has been presented to Kew by the Baroness Burdett Couts. Dr. M. C. Cooke has entered upon his duties as Cryptogamist of the Herbarium, taking charge of all the non-vascular cryptogams.

JAMAICA DOGWOOD, or *Piscidia Erythrina*, promises to come into quite prominent use as a medicine, the bark of the root yielding a drug that is claimed can be used as opium and with much better effects. It has been used in Jamaica and England as a nervous sedative, and a contributor to the *Therapeutic Gazette*, says that the

sleep produced by it is "tranquil and refreshing, and free from dreamy sensations." Something that will soothe irritated nerves without any evil result is surely a *desideratum*.

MAWAH FLOWERS (*Bassia latifolia*) are exciting a good deal of attention just now. This plant is cultivated as cattle food, and several tons of the flowers have been received in New York from Calcutta. When packed they form a dark brown, sticky mass which is anything but attractive. The flowers are very highly prized in India, both as an article of food and for use as a source of liquors. But the remarkable part of it is the nourishing material of the flower is lodged in the corolla, which is usually only a protective or attractive organ. This corolla contains no less than 63.40 per cent. of sugar, or more than half its weight. An excellent figure and full description of this curious plant appears in the *American Agriculturist* for September.

MR. LUCIEN M. UNDERWOOD, in the last *Torrey Bulletin*, gives some artificial synopses which are of considerable interest because they attempt to simplify such perplexing groups of plants. Of course the value of such keys depends upon their usefulness, and that can be easily tested. If we can take the synopsis of the *Umbelliferæ*, *Carices*, or *Salix* as given by Mr. Underwood and with reasonable ease find the specific name of any member of these groups, these pages of the *Bulletin* should be cut out and pasted in our Manuals.

THE AMERICAN JOURNAL OF SCIENCE AND ARTS for August, contains a very curious note in the Natural History Department of "Scientific Intelligence," which is rather unusual in that eminent journal, for it devotes half a page to a note on "Mucorini as the Chief Source of Mineral Coal," which in a clause at its close it shows to be unworthy of any notice. When an investigator announces conclusions that are "wholly opposed," not only to "those of other investigators." but to "the facts," and when he has "evidently misunderstood the objects under examination" and given us "supposed facts," it is generally supposed that *Silliman's Journal* will ignore him.

"DOG-FENNEL" seems to change its name with its place. In glancing over an agricultural paper we see notices of "dog fennel," and the eastern editor says it is *Eupatorium fœniculaceum*. This may be so where this *Eupatorium* grows, but to every man, woman and child in the west, "dog-fennel" means *Maruta Cotula*, or the eastern "May-weed."

PROCEEDINGS OF THE PHILADELPHIA ACADEMY, Part I, 1880, is just at hand, and we note the report of the committee on plants introduced by means of the International Exhibition. The report can be condensed into the simple word "nothing," for although 13 plants were found that were "strangers," not a single one of them showed any tendency to set seed or spread. Some of the 13 are our own western plants, others are from Europe, and a few from Japan.

NOTULÆ EXIGUÆ.—In the May number of the GAZETTE the undersigned asked for fresh seeds of *Ipomœa pandurata*. A few were kindly supplied by an obliging correspondent (whose letter and name have

been lost), and one has germinated. It behaves in the manner anticipated. In view of the curious behavior in germination of *Megarrhiza* and of *Ipomœa leptophylla*, which both agree in lengthening greatly the petioles of the cotyledons, and both have a huge root, it was thought likely that *I. pandurata*, which is also huge rooted, would also keep its caulicle short and elevate its cotyledons on long petioles. And we find that it does so. The germination of the tuberous-rooted species of New Mexico and Arizona, also of the Carolin an *I. Jalappa*, should now be observed. Mr. Darwin, always sagacious, has suggested that the object of this peculiarity is to leave the primary bud upon the apex of the huge root well underground, for its greater safety, whether against severe cold or drought. It will be interesting to know whether all the great-rooted *Convolvulaceæ* have this peculiarity. Seedlings of *Ipomœa Jalappa*, sent by Dr. Mellichamp from South Carolina, appear to present an intermediate condition.

A good illustration of the truth of the doctrine "ne nimium crede colori" is supplied by Dr. Charles W. Swan, of Lowell, Mass., who sends us white flowered individuals of *Gratiola aurea*, growing in the midst of bright yellow ones; also after a little search, some intermediate ones with pale yellow corolla.

In my First Lessons, in Structural Botany, etc., I have taken the embryo of Maples, without discrimination, as a pattern of embryo without a plumule ready-formed. I ought to have known the soft White-Maple (*Acer dasycarpum*), having thick cotyledons, well stored with nourishment, ought to have a ready-formed plumule. If I had thought of it and examined, I should have found it so, and should have used this species as an illustration. Mr. C. S. Deane, of Grundy, Iowa, has supplied my omission and called my attention to the fact. There is a good plumule in the seed, like that of the bean. In the books referred to, where Maples in general are mentioned, Sugar Maple and Red Maple are to be understood

Polygonum cilinode roots at the tip of slender axillary branches, and so propagates freely. This is noted by E. L. Hankenson, of Newark, New York.

Cleistogamous species of *Helianthemum* were supposed to exist only in America. Dr Ascherson calls attention to one in Spain and another in Egypt which were essentially indicated by Linnaeus and by Delile. He particularly confirms the fact, and speaks of a number of other plants which become cleistogamous in the African desert, where insects are scarce.

It was Prof. Decaisne, we believe, who long ago explained that the uncultivability of Rhinanthideous plants (such as *Pedicularis*, *Gerardia*, etc.) was owing to their parasitism in early life. He has, of late, succeeded in raising them well by sowing the freshly ripened seeds on turf, containing grasses and Leguminous plants. It should be tried with our Gerardias and the pretty *Orthocarpi* of California.—A. GRAY.

MESEMBRIANTHEMUM, not *Mesembryanthemum*.—So it is properly written by Jacob Breyne, who made the name, and by Dillenius

who took it up, both giving the derivation from "*mesembria*," midday, alluding to the time the blossoms open. But both Breyne and Dillenius about half the time wrote *Mesembryanthemum*. Linnæus, adopting the latter, became consistent by making a wrong and far-fetched derivation to match the orthography. Among systematic writers Sprengel almost alone keeps to the correct orthography, and Webb insists on it. The younger Breyne, in his edition of his father's Prodromus, has a note about it (p. 81). He mentions an excuse for changing the orthography, namely, that some species do not open the blossom at noontide, and intimates that Linnæus' derivation from the insertion of the corolla around the middle of the germ, is open to the same objection. If heeded, that kind of objection would be fatal to very many generic names.—A. GRAY.

POTAMOGETON VASEYI, ROBBINS.—This species has usually been considered the rarest of all our pond-weeds. The fructiferous form with floating leaves, perhaps, is so, having been detected, so far as I am aware, in only two localities in the United States and one in Canada. The submerged form, however, promises to be much more abundant. In company with Mr. Edwin Faxon, of Jamaica Plain, Mass., I dredged for it this summer in Lake Quinsigamond, where a few specimens, floating on the surface, were obtained some years ago by Dr. Robbins.

This sheet of water resembles one of the lochs of Scotland, lying in a deep hollow among low hills. It is almost five miles long by half a mile broad. The water deepens abruptly from the shore, having on the outer edge of the bed a belt of stones and pebbles. Within this the bottom seems to be composed of silt washed from the surrounding hills. In this silt, at a depth varying from six to twelve feet, throughout the lake, we found *P. Vaseyi* growing in great profusion. It was mixed with *P. Spirillus*, *P. pusillus* and *Naias flexilis*.

This form of the species has filiform stems, 6–18 inches high, sending up long branches from the base and shorter ones above; leaves scattered, setaceous, 1–nerved, 1–3 inches in length, and tapering to a long needle-like point; stipules delicate, free, acute, 3–6 lines in length and rather persistent. The plant is propagated exclusively by gemmae, which are much like those of *P. gemmiparus*, but usually smaller and more delicate.

Our find shows the importance, when searching for aquatics, of using a dredging rake. Plants as slender as this cannot be seen from the surface unless the water is extraordinarily clear, nor even then well enough to determine what they are. I have found myself repeatedly deceived in fishing up something dimly discerned on the bottom which proved to be very different from what I expected. Had we trusted to eyesight alone in this case, we should never have suspected what riches lay beneath the water.—THOMAS MORONG, *Ashland, Mass.*

BAPTISIA CALYCOSA, W. M. CANBY.—I have lately collected fine

specimens of this plant which has been in flower during the past month; and last year I had good opportunity for studying the legumes. The plant well deserves its name of *calycosa* as the calyx is very remarkable. Its lobes become somewhat enlarged in fruit, and nearly enclose the small legume, so that only the tips of the pod and the long curved style are exserted. The legume itself is about 4 lines long by 2 lines broad; the style is also about 4 lines long. Seeds 1–4, generally 2; base of stem woody. Stem 2–3 feet high, much branched; plant turns black in drying. I notice that the calyx is often 5–parted. A friend who lives in the region where this *Baptisia* grows, tells me that soon after the flowering season the plants are attacked by worms or caterpillars, which eat them greedily. Being unexpectedly obliged to remain in St. Augustine this summer, I expect to be able to include fine specimens of this plant in flower and fruit in my cheap sets for sale.—MARY C. REYNOLDS, *St. Augustine, Fla.*

THE COLLECTIONS OF DARLINGTON AND TOWNSEND.—It may possibly interest the old friends of the late Dr. Wm. Darlington and David Townsend, of West Chester, Pa, that the herbariums left by these gentlemen are now in the museum of the State Normal School of this place. The curators of the institution are having the plants carefully poisoned and glued down, together with the original labels mostly in the handwriting of these eminent botanists. Those especially left by Mr. Townsend are splendidly preserved, and indeed but few in the entire collection have been injured by insects. The typical local flora in the good old Doctor's herbarium, from which his *Flora Cestrica* was written, is interesting from the fact that the many forms of some changeable species are largely represented.—JOSIAH HOOPES.

PHYSALIS GRANDIFLORA.—In the month of June, 1878, I found a patch of *Physalis grandiflora*, growing in an old pasture lot, along the lowlands near the mouth of the Au Sable river, Iosco Co., Mich.

A specimen collected from this locality by myself is now in the herbarium of Dr. J. T. Rothrock, West Chester, Pa.

I believe this is the most southern limit at which this plant has been known to occur. At the date above mentioned it had never been reported south of the shores of Lake Superior.—C. B. COCHRAN, *West Chester, Pa.*

MICHIGAN LAKE SHORE PLANTS AND NOTES ON POPULUS BALSAMIFERA, VAR. CANDICANS.—The following list, together with the one published in the July GAZETTE, gives a somewhat general catalogue of the more distinctive flora of the sand dunes and beaches in the vicinity of South Haven, Mich.:

Nasturtium palustre, D.C, with the typical oblong pods. One plant was found on a dry, clay plot near the lake. *Arabis Canadensis*, L., common on high bluffs. *Cakile Americana*, Nutt., is not generally distributed along the beach. Of 100 average pods of this plant which I examined, only 47 had the seeds developed in both cells. *Silene*

antirrhina, L., is not uncommon in the sand. *Ceanothus Americanus*, L., occurs occasionally. The fruit is nearly as often 2–celled as 3–celled. Of 100 specimens of ripe fruit, 44 were 2–celled. *Phaseolus diversifolius*, Pers., often grows on the beach among rubbish.

It is worthy of note that *Cornus stolonifera*, Mx., is quite common on the highest bluffs. I have seen it growing luxuriantly in drifting sand over a hundred feet above the lake, and blossoming from June till near September. I have also seen fine plants of *Cephalanthus occidentalis*, L., growing in the loosest white sand, and far out of reach of the lake.

A form of *Solidago Virga aurea*, L., somewhat approaching var. *humilis*, occurs on the higher bluffs. *Cacalia atriplicifolia*, L., is abundant on wooded bluffs. *Hieracium Gronovii*, L., is often found in the same localities. *Penstemon pubescens*, Sol., is not generally abundant. *Monarda punctata*, L., is very common in dry sands. A dwarf and entirely prostrate form of *Amarantus albus*, L., occurs on low lands The branches are bright red, the axillary clusters of flowers longer than the typical species and the whole plant presents a polished appearance.

On moist, grassy banks I find *Habenaria hyperborea*, R. Br., and along with it *Liparis Loeselii*, Richard. In the same locations occurs *Carex aurea*, Nutt. *Cyperus Schweinitzii*, Torr., grows on low banks; not common.

Of the grasses which grow on the sand dunes the most conspicuous are *Calamagrostis longifolia*, Hook., *Oryzopsis melanocarpa*, Muhl., *Festuca ovina*, L., *Elymus Canadensis*, L., var. *glaucifolius*, *Danthonia spicata*, Beauv., and *Panicum virgatum*, L.

In the last GAZETTE I stated that *Populus balsamifera*, L., var. *candicans* was native here. I have received inquiries as to why I think it indigenous. There is no doubt but that it is native both at South Haven and Bangor, Mich. As before stated, the existing specimens at this place are the remnant of a long grove, which contained large and thoroughly established trees when the first pioneers visited the place. They appeared to be coeval with the surrounding forest, with which they were interspersed for some distance back from the lake shore. Many of the trees were large enough for sawing timber. When they were discovered there were no settlements in Van Buren Co., and none within 25 miles on the lake shore.

At Bangor, ten miles inland, there was a large grove of these trees when the first settlers visited the place. Many of the trees were two feet in diameter and over 75 feet high. They were all destroyed years ago, but transplanted specimens can now be seen in that village. —L. H. BAILEY, JR., *South Haven, Mich.*

NOTES FROM ARKANSAS.—Double flowers of *Thalictrum anemonoides* with white and pink petals are not uncommon in N. W. Arkansas.

A great number of flowers of *Hypoxys erecta* upon the plan of double four were found last spring.

It is not uncommon to see *Tradescantia Virginica* built upon the

plan of single four. I noticed one with four petals and only two sepals, the fourth colored organ occupying the position of a sepal. (As the nature of an organ depends upon its position rather than its color or texture, this *Tradescantia* had three petals and three sepals, one of the latter having become petaloid.—Ed.)

Collinsia violacea often has 7 flowers in a whorl, also the petals are blue, not *violet.*

Penstemon tubiflorus with three leaves in a whorl was found by Mr. F. W. Ellis, one of my pupils.

Trillium sessile, var. *Nuttalliana*, occurs with four leaves instead of three.

Scilla Fraseri sometimes has white flowers.

Ophioglossum vulgatum was found growing on the flat top of a limestone ledge 200 feet above the valley.

Æsculus glabra was found growing in Madison Co., Crawford Co., and as far south as the Red River. It attains a diameter of 15 inches in the Ozan bottom in Hempstead Co.

Found *Acer saccharinum* as far southwest as the Bois d'arc Creek, a northern tributary of Red River.

Magnolia acuminata occurs in Garland, Montgomery, St. Francis and Crawford counties, and probably in many other places.

Acer dasycarpum was found as far south as the Saline River in Saline Co.

Robinia Pseudacacia grows in Hempstead Co., on the "Black Lands."

Gymnocladus Canadensis occurs in Garland Co.

Prunus Chicasa undoubtedly grows wild in Southwestern Arkansas.

Pirus coronaria grows abundantly as far southwest as Red River in Arkansas. The fruit is very deeply depressed at the stem and blossom ends, and is more than twice as broad as long. I have been accustomed to seeing it nearly globular in the Western States.

Amelanchier Canadensis occurs in the mountainous regions of Southwestern Arkansas.

Nyssa uniflora was found as far north as Little Rock in cypress swamps.

Fraxinus quadrangulata occurs in Garland, Hempstead and St. Francis counties and in the northwestern part of the State.

Maclura is plentiful in Southwestern Arkansas.

Quercus bicolor is not uncommon in all the river bottoms of S. W. Arkansas.

Q. imbricata occurs in N. E. Arkansas.

Q. microcarpa occurs as far southwest as Red River.

Q. lyrata is the principal growth in some of the bottoms of the northern tributaries of Red River.

Catalpa speciosa grows large in Hempstead Co. Measured one tree 13 feet 10 inches in diameter, and saw several trees about 4 feet. This species, I learned, was introduced from Louisiana, but it is now spontaneous all along the creek bottoms of that region.

Juglans cinerea was found in abundance near Forest City, St. Francis Co., on Crowley's Ridge, growing along with *Magnolia acuminata*, *Liriodendron Tulipifera* and *Fagus ferruginea*. The latter attains a diameter of over three feet. It was also found in Clark, Ouachita, Columbia, Union, Miller, Nevada, Hot Springs, Dallas, and formerly in Hempstead counties.

Ostrya Virginica is very common as far southwest as the border of the State.

Juniperus Virginiana was found as far southwest as Hempstead county.

Castanea pumila attains a remarkable size in Hempstead Co., on the sandy soil of the Tertiary. A tree in the suburbs of Washing measured 13 feet 8 inches, one foot from the bottom, and several trees were observed over 3 feet in diameter.

There was a specimen of *Juglans nigra* formerly standing in the Red River bottom, of which only the stump now remains. This tree was measured by Col. Graliot (Col. 2d Ark. Infantry), now County Surveyor of Hempstead Co. It took 45 paces (?) to go around the tree, and 5 feet above the roots the Colonel could just hold together, with extended arms, the ends of a 33 foot chain, making the circumference at least 38 feet.

The genus *Cratægus* is represented by a large number of species in N. W. Arkansas.

The genus *Carya* is represented by seven, if not the eight, N. Am. species.—F. L. HARVEY, *Ark. Ind. Univ. Fayetteville, Ark.*

"SAXIFRAGA UMBROSA" ADORNED WITH BRILLIANT COLORS BY THE SELECTION OF SYRPHIDÆ.—Among Diptera the most assiduous visitors of flowers are certain Syrphidæ, which, elegantly colored themselves, are fond of splendid flower colors, and before eating pollen or sucking nectar, like to stop awhile, hovering free in the air, in front of their favorites, apparently fascinated, or at least delighted, by the brilliancy of their colors. Thus I repeatedly observed *Syrphus balteatus* hovering before the flowers of *Verbascum nigrum*, often *Melanostoma mellina*, and *Ascia podagrica* before *Veronica chamædrys*; in the Alps the lank *Sphegina clunipes* before *Saxifraga rotundifolia*, and in my garden *Ascia podagrica* before *Saxifraga umbrosa*. Of *Verbascum nigrum* the main fertilisers are humble-bees, Diptera co-operating only in a subordinate degree; in the case of the three other species, on the contrary, the above named Syrphidæ are such frequent visitors and cross-fertilizers that we may safely conclude that it is by their selection of elegantly colored varieties that these flowers have acquired their beautiful peculiarity. Hence, in order to estimate the color-sense of these Syrphidæ, it is worth while to consider what color-combinations they have been able to produce by their selection.

Saxifraga umbrosa being, as far as hitherto known, their finest masterpiece, we may in the first place look at the variegated decoration of this species. Its snow-white petals are adorned with colored spots, which in size and intensity of light gradually decrease from the

base of the petals towards their extremity. Indeed, nearest to their base, within the first third of their length, there is a large irregular spot of an intense yellow; about the middle of their length there follows a narrower cross band of red color, vermilion towards the base, intensely pink towards the outside, not reaching the margin of the petals, sometimes dissolved into several separate spots; lastly, beyond the middle of the length of the petals there are three to eight smaller roundish spots of a paler violet pink color. The flowers of *Veronica chamædrys* prove that also gay blue colors are perceived and selected by Ascia.—Hermann Muller *in Nature*.

Carex Sullivantii.—Mr. E. C. Howe, of Yonkers, West Chester Co., N. Y., writes that he has collected during the present season several specimens of the above *Carex*, and would like to exchange them for some Western Carices, such as *C. Shortiana*, *C. Meadii*, *C. Bebbii*, *C. crus-corvi*, *C. conjuncta*, *C. muricata*, *C. cephaloidea*, or *C. Fraseriana*.

Cross Fertilization of Baptisia tinctoria.—Prof. W. W. Bailey writes in reference to *B. tinctoria* that it is cross fertilized by humble bees. Their weight on the keel causes a quick and decided lateral deflection of the wings, exposing the androecium. A careful study of this mechanism would be very interesting.

Downingia pulchella.—In a field east of San Jose I saw last June at least five acres completely carpeted with *Downingia pulchella*. The nearly level ground had been sown with wheat which the April flood "drowned out" in the lowest places. In September the same ground will be covered with cocklebur.

The rare *Mentzelia Lindleyi* is abundant near Alum Rock, seven miles east of San Jose.—V. Rattan, *San Francisco, Cal.*

New Locality for Sullivantia Ohionis.—Happening to spend a day in the eastern part of Cass county, Indiana, I found on the limestone bluffs overhanging Pipe Creek, just before its junction with the Wabash River, *Sullivantia Ohionis* in abundance The general conformation of the country and the relative situation of *Sullivantia*, are almost exact counterparts of the station in Jefferson Co., Indiana, with the single exception that the bluffs are not nearly so high. The exposure and character of the soil seem to be identical.—M. S. Coulter, *Logansport, Ind.*

Science.—A Weekly Record of Scientific Progress. Illustrated. We have received the initial number of the above journal, which claims to "occupy a field in periodical literature hitherto unoccupied," "and the only first class weekly Journal in the United States devoted to science, recognized by scientists as their medium of communication." Furthermore, all desiring to keep "au courant", or rather

to be kept "au courant," since "Science" is the active agent, will find this journal invaluable. Having dipped thus far into the prospectus, we turned from the field of superlatives into the list of contributors. These are superlative, their names being a sufficient guaranty of the undertaking. In Vol. 1, No 1, we have articles by Prof. E. S. Holden, Prof. Burt G. Wilder, Francis P. Upton, and others, together with a mass of well selected extracts After a close examination of its contents, however, we find not to exceed three notes bearing upon botanical subjects. Such being the case we cheerfully advise all to subscribe for it, addressing John Michels, editor, box 3838, New York, and enclosing $4 the "*sine qua non.*"

The Monthly Index to Current Periodical Literature, Proceedings of Learned Societies and Government Publications. Published at office of American Bookseller, 10 Spruce Street, N. Y., at $1 per annum. Under the above somewhat extended title, we have the *vade mecum* of the specialist, since it gives the titles of the latest articles written in almost every department of Natural History, Philosophy, Biography, Education, Religion, Art, Æsthetics, Architecture, Music, Archæology, Anthropology, Ethnology, Folk-lore, etc., etc., with the name of author and number of pages. Without claiming to "meet a long felt want" it does it admirably. Address as above.

Nectar, Its Nature, Occurrence and Uses. By Wm. Trelease, Ithaca, N. Y. We have received the author's edition of the above pamphlet, and hope in our next issue to make a full review. It is extracted from the report on cotton insects by J. Henry Comstock, Entomologist to the U. S. Department of Agriculture. The extract is 25 pages with a full page steel plate containing 13 figures.

Rudimentary Coma in Godetia.—While investigating the development of the embryo-sac in the different genera of *Onagraceæ*, my attention was attracted to certain hair-like projections which appeared upon the forming ovule of *Godetia*, probably *G. grandiflora*. A careful examination showed them to be identical in structure with the forming hairs in the coma of *Epilobium*. They occurred almost exclusively at the chalazal end, one or two scattered ones being detected farther down upon the raphe. A study of the development of the coma of *Epilobium* shows that the first indication of it is a tuberculated appearance at the chalazal end. Presently these tubercles push out into elongating nucleated cells which eventually develop into the long hairs of the coma. Now *Godetia* permanently retains this tuberculated margin at the upper end, but does not usually develop its coma any farther. In the cases examined, however, the forming ovules, either in reminiscence or prophecy, stretched out their tubercles into incipient hairs. Tracing these ovules in their subsequent development it was found that these hairs gradually disappeared until when the ovules had become anatropous, there was no indication of them. As *Godetia*

has been merged into *Œnothera*, many species of the latter were examined to see if any such thing occurred in them, but no trace of such growth was detected. This would seem to indicate that if *Godetia* is not entitled to generic rank, it is at least that part of *Œnothera* which looks towards *Epilobium*.

A discrepancy must be noted here, however. In *Epilobium* the hairs of the coma do not begin to form until the ovule has become completely anatropous. But in the *Godetia* observed the incipient coma had all disappeared by the time the ovule had become anatropous, beginning to form before the nucleus is half covered by the coats. These hairs appeared in greatest size and abundance when the axis of the ovule was at right angles to its anatropous position.—J. M. C.

BOTANY FOR HIGH SCHOOLS AND COLLEGES, by Charles E. Bessey, M. Sc, Ph. D; Henry Holt and & Co., New York, 1880—The question may naturally arise in the minds of many teachers, what need is there of another botany? We have Gray's, Wood's, Youman's, etc, almost every publishing house being represented by a botany; surely it is but publishers' rivalry that is throwing this new book upon the market. Even a casual glance will show, however, that we have here no stereotyped repetition of books that have gone before, but a new departure in American botanical text books. The time has long past when the study of any of our botanical text books will be sufficient to impart even a general knowledge of the science of botany. Once the study of a little morphology, the learning of a few terms in the glossary, and the analysis of a few flowers was thought to be all the profitable study that botany could furnish students. But this state of things has entirely changed and plants are getting to be recognized as living organisms that have life histories, and that have digestion, nutrition, assimilation, circulation, respiration, reproduction and other functions just as remarkably performed as in animals. The question then arises, is it more profitable to study the plant in its life work, or simply to dissect and name its parts and their probable function. It is evident that we can study plant physiology as well as anatomy, and it is this very thing that has been so long neglected in our schools, neglected from lack of suitable text books. Our great botanists have been systematists, as is perfectly natural in a country just developing its flora, hence all botanical work in the schools has followed the same bent. Such work is not to be decried, for it is absolutely necessary and well enough as far as it goes, but it is not all of botany. To our country belong some of the finest works on morphology and classification published and they rank as the very highest authorities, but our physiology remains yet to be written. Prof. Goodale has for several years had such a work in contemplation, but its publication has been delayed, and now Prof. Besey is the first to occupy this new field.

His book is divided into two parts. Part I is upon the subject of General Anatomy and Physiology. Part II treats of Special Anatomy and Physiology. To give our readers a general idea of

this important and excellent work we give a running summary of its contents. Part I contains 12 chapters; the subject of Chapter I being Protoplasm; Chapter II treats of the Plant-Cell; Chapter III, Cell Wall; Chapter IV, the Formation of New Cells; Chapter V, the Products of the Cell, such as chlorophyll, starch, aleurone and crystalloids, crystals in cells, cell-sap, oils, resins, etc.; Chapter VI, Tissues, taking up first the various aggregations of cells, then the seven principal tissues, and last the primary meristem; Chapter VII, the Tissue Systems, the sections being the Differentiation of Tissues into Systems, the Epidermal System of Tissues, the Fibro Vascular System of Tissues, the Fundamental System; Chapter VIII, Intercellular Spaces, and Secretion Reservoirs; Chapter IX, the Plant Body, treating of Generalized Forms, Stems, Leaves in General, Arrangement of Leaves, Internal Structure of Leaves, Roots of Plants; Chapter X, the Chemical Constituents of Plants, considering Water in the Plant, Solutions and Plant Food; Chapter XI, the Chemical Processes in the Plant, such as assimilation and metastasis; Chapter XII, the Relations of Plants to External Agents, as temperature, light, gravitation, etc.

Part II begins with chapter XIII upon classification; Chapter XIV considers the Protophyta; Chapter XV, the Zygosporeæ; Chapter XVI, the Oosporeæ; Chapter XVII, the Carposporeæ; Chapter XVIII, Bryophyta; Chapter XIX, the Pteridophyta; Chapter XX, the Phanerogamia; Chapter XXI is devoted to some concluding remarks upon the number of species of plants, the affinities of the groups of plants, and the distribution of plants in time.

Of necessity the work could not be entirely or even mostly original, but rather in Part I a following of that done in the German laboratories and based chiefly upon Sachs' great "Lehrbuch." In Part II the higher plants of course conform to the system of Bentham and Hooker. The classification and treatment of the lower plants seem to be the author's own work and is probably the part of the book that is most original. Part I would at once strike one as a simplified edition of Sachs, for many of his plates are there, and how could it be otherwise, for there are no better. One naturally first turns to those subjects in which he is especially interested and passes his judgment upon a work by what he reads there. Of course this is hardly fair, but it is natural. As the writer has been engaged in investigating the development of the embryo-sac, that subject was naturally looked into first. And, in passing, we must most heartily commend the excellent indexes which make it a pleasure to look up any topic. It seemed to us that Vesque's work in the development of the embryo-sac had been neglected, and the subject was left either in the most uncertain light or with the old idea of the embryo-sac being nothing but an enlarged cell of the nucleus. A careful series of investigations by the writer has confirmed the most important of Vesque's conclusions, and it seems to us that the development of the embryo-sac, with its beautiful division of labor would be interesting to any student. The notion that the embryonal vesicle does not originate in what is to become

the embryo-sac is not spoken of, although repeated observations have proved that there is at first a distinct separation between the sexual cell and the enlarging embryo sac. The "primordial mother-cell of the embryo-sac" can be clearly made out also by any ordinarily careful observer, and then its breaking up into the axial row of four or five cells, the uppermost one of which contains the vesicle and "synergides," the second becomes the embryo sac and the two or three remaining ones subsequently secrete endosperm, can be readily traced. This is mentioned simply because it seems a pity that such an interesting line of investigation was not suggested. There is an abundance of work suggested, however, for the most active class, and we hope that very many classes will undertake it. The author plunges "in medias res," or begins at the beginning, whichever way one looks at it, by introducing as the subject of the very first paragraph, "Protoplasm" This plan he follows throughout, not avoiding the difficult points, but by directly encountering them, before the student knows it he has a clear idea of some very uncertain subjects. With Dr Gray's admirable new text book on Structural Botany and this upon Physiology, the student of botany can get a very excellent knowledge of the science. The arrangement of the book is mostly new and at first glance most excellent, a thing of course to be tested in the class room. As to innovations, the author himself calls attention to two. In Chapter VI he recognizes seven well marked kinds of tissue, viz.: Parenchyma, Collenchyma, Sclerenchyma, Fibrous Tissue, Laticiferous Tissue, Sieve Tissue, and Tracheary Tissue. Of course these include a great many varieties which pass into each other by almost insensible gradations. The other innovation "consists in raising the Protophyta, Zygosporeæ, Oosporeæ, and Carposporeæ to the dignity of Primary Divisions of the vegetable kingdom, co ordinate with the Bryophyta, Pteridophyta and Phanerogamia." The book also contains constant suggestions with regard to laboratory work, such as the best plants from which to get certain tissues, etc., and the best method of treatment. This enables the student to go into the laboratory alone, or rather with the aid of the experience of Prof. Bessey, one of the most successfull of teachers, and perform satisfactorily all the elementary work in the histological structure of plants. We would most cordially commend the work to the use of all professors and students of botany as not only the *best* American book upon the subject, but the *only* one.—J. M. C.

THE VALLEY NATURALIST, Vol. II. No. 1—This enterprising journal has again made its appearance and this time it appears that its subscriptlon list makes its success assured. It has now 16 pages and a cover, the subscription price being $1.50. There is surely room for such a publication in the great Mississippi Valley, but a constituency of scientific subscribers and contributors is exceedingly slow to build up. The publisher is Mr. Henry Skaer, N.W. Cor. Third & Pine Sts., St. Louis, Mo.

PACIFIC COAST FLOWERS AND FERNS.—Mr. J. G. Lemmon, of Oakland, Cal., is offering some very fine plants at exceedingly low rates. He is an indefatigable collector, having traveled extensively through the West, and his collections embrace plants from Southeastern Arizona to Washington Territory. He has over 400 of the characteristic plants of Arizona, many of which are entirely new to science. He offers for sale also a collection of 50 species of Pacific Ferns, including many rare and new ones. The following terms place these rare plants within the reach of all who care to have them:

Sets of good specimens of the phænogams will be carefully selected, correctly labeled and forwarded to any address in the United States, free of postage, for $7.50 per 100. Sets of the ferns at $10 per 100. New Ferns at 25 cents each. The sets will be ready for distribution during the Christmas holidays. Applications should be in hand before December.

DECANDOLLE'S PHYTOGRAPHY.—In the American Journal of Science and Arts for August and September, Dr. Gray gives a running account of the contents of DeCandolle's last work, which is so interesting and instructive that we copy a few extracts from it.

Chapter XIII relates to difficulties in phytography which have grown out of various methods or absence of method in the nomenclature of organs, and from the want of consideration of the law of priority in such matters. The result of which in some departments, such as histological morphology, is a state of anarchy not unlike that which prevailed in the names of groups before the days of Tournefort and Linnæus. We may hope that order and lucidity will some day dawn upon this chaos and a common language replace this confusion of tongues. Meanwhile DeCandolle offers certain counsels, the utility of which, he says, is not doubtful nor the application very difficult.

(1) Hold fast to common and universally known names, whether in Latin or in modern languages. *Radix*, *caulis*, *folium*, *flos*, etc., with the vernacular equivalents, are not to give place to new-fangled substitutes. This, he thinks, will rid us of "such useless terms as *caulome*, *phyllome*, etc." Now these terms, along with *trichome*, seem to us legitimate and useful, as succinct expressions of a morphological idea; they are annoying only when pedantically ridden as hobbies over ground on which they are not wanted.

(2) Do not entertain the idea that a change in the mode of considering or defining an organ requires a change of name. Although Linnæus did take the leaf-blade for the leaf, and define it accordingly, that did not much hinder the coming in of a truer view, involving merely a change of the definition. But one may intimate that DeCandolle here comes into conflict with another rule he insists on, namely, that terms should have unmistakably one meaning. When we say—as we ever shall—that leaves are ovate, we speak according to the Linnæan definition; when we say that their insertion is alternate, we use the word in a more comprehensive sense; when we have occasion to declare that cotyledons, bracts, petals, etc., are leaves, we use the word in the most comprehensive sense. All this involves considerable am-

biguity; and the endeavor to keep the new wine in the old bottles causes no little strain. It is borne because it has been applied gradually. If Linnæus had started with, or even reached our ideas, we should happily have had a nomenclature to match. Now we must be content, for descriptive purposes, to employ some words both in a restricted and in a comprehensive sense, and let the context fix the sense, just as it must in ordinary language. Technical precision is only a matter of degree. But it is clear that the excellent rule here laid down need not forbid the introduction of terms to express our conceptions, such as *rhizome*, *caulome*, *trichome*, and the like. Yet these are ill-chosen terms, except the last. In particular, *rhizoma* has long ago been appropriated for something which is not of root nature, but the contrary.

(3) The third counsel is to change the name of an organ, as we do that of a genus or species, only when it is positively contrary to the truth, or when it has been pre-occupied.

(4) Avoid giving special names for rare or ill definable cases of structure. An epithet or short periphrasis is vastly preferable to a new and strange term, which will be seldom used and may be hardly understood. DeCandolle truly remarks that after a great multiplication of terms and distinctions generally comes some good generalization, which does away with a crowd of particular names; that what has happened in carpology is likely to occur for microscopic organs.

(5) Between two or more names choose, not the most agreeable, or even the most significant, but the one best known and most widely recognized

(6) Between names equally known and used adopt the oldest. Which are the older names is not difficult to know in the case of common organs, but is very much so in modern histology.

(7) In this matter of priority or of usage, consider only names taken from (or in conformity with) Latin or Greek. As in systematic botany, scientific and not vulgar names are to be accounted in this regard. Those who like *spaltœffnung* for *stoma* or *stomate* and *scheitel zelle*, must needs follow their own fashion; but the genius of our own and the French language resists their importation, while it adopts or adapts with ease technical terms from classical sources.

(8) Not to admit names contrary to these rules.

Chapter XVI is an interesting and pertinent one, upon the manner in which facts observed under the microscope are described; and on the great saving of space and advantage in clearness which would be gained by the adoption, for all matters perfectly capable of it, of the Linnæan descriptive style, and of Linnæan Latin. Extracts from the German of Schacht, the French of Payer, and the Italian of Gasparrini are given, and by their side a rendering in descriptive Latin; and the words and letters are counted. The German specimen so treated is diminished to considerably less than half the number of words and a little less than half the number of letters. The French simmers down to one-third the number of Latin words and less than half the number of letters; and in the French of descriptive botany to

less than one half. The Italian extract of 51 words and 256 letters is expressed in Latin of Linnæan form by 21 words and 127 letters.

To give the readers of the GAZETTE an illustration of the space saved and the clearness gained by the change to Linnæan Latin we give an extract from Schacht's *Lehrbuch der Anatomie und Physiologie* as quoted and changed by DeCandolle.

TEXT.

"Die Spaltœffnungen (stomata) gehoerem der Epidermis, sie enstehen schon sehr fruh wenn dieselbe noch Epithelial-Beschaffenheit besitzt. Innerhalb einer Zelle der Oberhaut bilden sich namlich durch Theilung zwei neue Zellen, die Membran der Mutterzelle wird darauf resorbirt und die beiden Tochterzellen weichen in der Mitte eine Spalte zwischen sich lassend, aus einander; nach der Turgescenz der Spaltœffnungzellen erscheint nun die Spalte bald enger, bald weiter. Alle Spaltœffnungen der Hohengewaechse bilden sich auf diese Weise, sie bestehen desshalb sæmtlich aus zwei Zellen, den so genannten schliefszellen."

Same Facts in Linnæan Style.

Stomata in epidermis junioris epithelio nascuntur. Intra cellulam unam duæ novæ partitiones apparent, quæ sorores membrana matris soluta fluctuant et fissuram inter se angustam latumve monstrant; quippe vegetabilium superiorum stomata e duabus cellulis germanice *Schliefszellen* (1) vocatis constant.

Style in botanical works is discussed in Chapter XVIII, which all young botanists should study, especially the portion which treats of the admirable style of Linnæus. In speaking of botanical style in the modern languages, the author notices the great advantage which the languages of Latin stock have inherited, and which the English-writing botanists have acquired, of ready and free use of Latin and Latinized technical words by direct transference. Botanical French, English, and Italian, are contrasted with the German in this respect. Noting that the German of conversation inclines to be clear and sententious, while in botanical writings the words lengthen more and more and the sentences become badly involved, our author remarks that recently having read a couple of pages of Vegetable Anatomy, and feeling his brain somewhat fatigued with the frequency of such words as *Sclerenchymfasergruppen*, *Gefassbundentwickelung* and *Entwickelungseigenthumlichkeit*, he asked himself if that was good German style. He then recollected that Gœthe, one of the very greatest of German literary writers, was also a profound naturalist. He opened his *Metamorphose der Pflanzen*, read a page or so, and experienced a relief which he likens to that felt by a sea tossed ocean voyager when the vessel suddenly glides into a quiet harbor.

SYNOPTICAL TABLE FOR THE DETERMINATION OF FIBERS OF VEGETABLE ORIGIN.—The following table is from Vetellart's work "sur les fibres emp oyes dans l'industrie," and may be made considerable use of by botanists in the laboratory. W. H. Seaman, of the Department of Agriculture, in sending an abstract of Vetellart's work to Dr. Gray writes that "Vetellart does not tell much that is new, but has systematized our previous knowledge more than has ever before been done.

The reaction is given with dilute sulphuric acid and iodine; the most highly organized structure giving blue reaction, the less so yellow. Exactly as the more highly organized structures polarize light more strongly, e. g. spiral vessels polarize, parenchyma does not."

Synoptical Table for the Determination of Fibers of Vegetable Origin.

MONOCOTYLEDONS GIVING BLUE REACTION.

Common Name.	Botanical Name.	Where Grown.	Principal Use.	Length of Fiber			Ratio: Diameter to Length.	Diameter of Fiber.		
				Shortest.	Mean.	Longest.		Smallest.	Mean.	Largest.
Spanish grass.	Stipa tenacissima.	Algeria, Spain.	Paper.	5	1.5	3.5	125	.007		.018
Esparto.	Lygeum sparteum.	Spain.	"	1 3	2.5	4.5	160	.012	.015	.020
Pine Apple.		Torrid Zone.	Cordage.	3	5	9	830	.004	.006	.008

MONOCOTYLEDONS GIVING YELLOW REACTION.

New Zealand Flax	Phormium tenax.	New Zealand.	Cordage.	5, 8	9	15, 10	550	.010	.016	.024
Adam's Needle.	Yucca.	Western America.	Paper.	.5	4	6	170	.01	.020	.02
Bowstring Hemp.	Sanseviera Zeylandica.	Torrid Zone.	Cordage.	1 5	3	6	150	.015	.020	.026
Century Plant.	Agave Americana.	Warm Temp Zone.	"	1.5	2.5	4	100	.020	.024	.032
Banana Hemp.	Musa textilis.	Tropics (Philipine).	"	3	6	12	250	.016	.024	.032
Palmetto, etc.	Chamærops humilis.	Warm Temp. Zone.	Paper.							
Date Palm.	Phœnix dactylifera.	" " "		2	3		150	.016	.020	.024
Talipot.	Corypha umbraculifera.	Tropics.		1.5	3	5	120	.016	.024	.028
Palm-oil palm.	Elais Guinensis.	"		1.5	2.5	3.5	230	.010	.011	.013
	Mauritia flexuosa.									
	Raffia tædigera.									
Cocoa.	Cocos nucifera.			.4	.7	1.		.012	.020	.024
Vegetable bristles.	Arenga saccharifera.									

Synoptical Table for the Determination of Fibers of Vegetable Origin.

DICOTYLEDONS GIVING BLUE REACTION.

Common Name.	Botanical Name.	Where Grown.	Principal Use.	Length of Fiber.			Ratio: Diameter to Length.	Diameter of Fiber.		
				Shortest.	Mean.	Longest.		Smallest.	Mean.	Largest.
Flax-Linen.	Linum usitatissimum.	Temperate Zone.	Thread-cloth.	4	25-30	66	1200	.015	022	.037
Hemp.	Cannabis sativa.	" "	Cordage.	5	15-25	55	1000	.016	.022	.050
Hop.	Humulus Lupulus.	" "		4	10	19	620	.012	.016	.018
Nettle.	Urtica sp.	" "		4	27	55	550	.02	.05	.07
China-grass.	Borhmeria nivea.	Warm Temp. zone.	Grass-cloth.	60	120	200	2400	.05	.08	
Paper Mulberry.	Broussonetia papyrifera	" " "	Paper (in Japan).	6	15	25	240, 430	.025	.030	.035
Sunn.	Crotalaria juncea.	(India) Torrid "	Cordage. Sail Cloth.	4	7.8	12	260			
Broom.	Genista scoparia.	Temperate "	Paper.	2	6	9	330			
Spanish Broom.	Spartium junceum.	South " "	Cloth-paper.	5	10	16	500			
White Melilot.	Melilotus alba.	North " "		5	10	18	330			
Cotton.	Gossypium.	South " "	Cloth.	25, 10	25	40, 20				

DICOTYLEDONS GIVING YELLOW REACTION.

Hibiscus.	Hibiscus cannabinus.	Temperate Zone.	Cordage.	2	5	6	240	.014	.021	.033
Linden.	Tilia Europea.	" "	Mats.	1.25	2	5	125	.014	.016	.020
Jute.	Corchorus sp.	(India) Torrid "	Coarse Cloth, Etc.	1.5	2	5	90	.020	.0225	.025
Lace-bark Tree.	Lagetta lintearia.	Brazil Antilles.	Strings.	3	5	6	500	.01		.02
Willow.	Salix alba.	Cold Temp. Zone.	Cords, Cloth.		2	3	90	.017	.022	.030

THE ANTHERS OF CLETHRA.—To all eastern botanists our common *Clethra*, *C. alnifolia*, L., is certainly familiar, yet as far as I know no one has noticed the striking peculiarities of the anthers. In the more southern species, *C. acuminata*, Mx., these are even more marked. During the past summer I had opportunity to make a careful study of both species in all stages except fruit. According to Bentham and Hooker (Gen Plant. II, 603) the genus *Clethra* is a waif as far as the suborders of Ericaceæ are concerned—"genus anomalum," they call it—but Dr. Gray (Syn. Fl. N. A. II, 17) places it among the *Pyrolineæ*.

There is nothing peculiar in the development of the flowers. In *C. alnifolia* there is a marked difference between the outer and inner whorl of stamens while young, the latter being noticeably shorter. From the very beginning the anthers are *extrorse* and when young very decidedly epipetalous. They begin as mere knobs at the base of the petals but soon become sharply sagittate, which shape they retain. As long as the anthers are enclosed in the bud the filaments are bent upon themselves, but differently in the two species. In *C. alnifolia* they are shaped like a fish hook bearing the anther at the point corresponding to the barb, while the filament is represented by the shank. In *C. acuminata* the filament resembles an interrogation point (?) except that the first bend (counting from below upwards) is almost a right angle instead of a gradual curve. In all species these bends are more or less marked as may be seen in various figures.*

But in none of the figures referred to is to be seen anything peculiar about the anther or connective, though several figure the enlarged stamens. Not in any of the descriptions of foreign species is there notice of anything in the structure of the anthers to provide for their retroversion at anthesis common to the whole genus †

As soon as the flower begins to open, the growth of the filaments, which is extremely rapid at this time, pushes the anther beyond the corolla, and it, relieved of the compression of the petals, immediately springs to a horizontal position. The completion of obversion until the anther becomes *introrse* then proceeds more slowly though it is accomplished in a few minutes after the first spring has taken place. There seem to be two causes for this freak. The straightening of the filament both lengthens the stamen and continues the somersault begun by a special device, viz.: a cushion of turgid cells on the back of the connective. This cushion is continuous with the filament, but is not joined to the connective throughout its whole extent, being arched away from it about the middle of the anther. The cushion divides into two tongues, which taper to slender points as they pass down the thecæ. Under the microscope the cells of the upper part of the filament and of this cushion are seen to be turgid while the anther is still held by the corolla, but soon after it escapes these become shriveled and the cushion withers first. The outside cells are shown by a

*Vide Meissn. in Mart. Fl. Bras. VII, t. 64, 65, 66.—Lam. Illustr. t. 369.—Bot. Mag. t. 1057, 3743.—Lindl. Bot. Reg. 1842, t. 23.

†Vide DC. Prod. VII, 5-9.—Walp. Rep. II, 726; VI, 417; Ann. I, 479.—Miq. Fl. Ind. Bat. II, 1056.—Griseb. Fl. Brit. W. Ind. 141.

cross section to be thinner-walled and larger than the inside ones and all are filled with oil globules of various sizes in addition to the protoplasmic contents. This cushion is about 1–60th of an inch in width and one-half that in thickness. Near the center, as also of the connective, runs a fibro-vascular bundle.

Between our two species there is a difference in the time of dehiscence of the anthers—those of *C. alnifolia* not breaking until complete anthesis, while in *C. acuminata* they break just as the petals separate at the top. Both are proterandrous. Both also are very fragrant, but the fragrance is earlier perceptible in *C. acuminata*, correlated with the earlier dehiscence of the anthers. In this species the nectaries are very large and double, one on each side of the filament at the base of the petals. In *C. alnifolia* they are smaller and apparently single, situated between the filament and the petal.

Fertilization is effected almost altogether by honey bees. They alight on the outspread petals and thrust the head down by the side of the style frequently touching the stigmas. In crawling around over the spike of flowers almost every part of the body comes in contact with the stigmas. Cross-pollination is thus abundantly provided for as usual both by proterandry and the visits of insects.

I have not Bentham and Hooker's Genera Plantarum by me, but if my memory is correct they say "Pollen globosa." I find the pollen of both our species elliptical with three slits, as stated by Edgeworth and only globose after the absorption of water.—C. R. Barnes, *La-Fayette, Ind.*

Vesque's Development of the Embryo sac.—In the *Annales des Sciences Naturelles*, 1878, M. Julien Vesque, after discussing the development of the embryo-sac of Angiosperms, draws the following conclusions, which somewhat modify our previous notions concerning the embryo sac. Or rather our text books merely stated that it was an enlarged cell of the nucleus without giving any account of its development.

M. Vesque now fills this hiatus and as his conclusions have been mostly confirmed we feel confidence in printing them in the Gazette, urging upon our physiological botanists to test them as far as they are able.

1. In the Angiosperms the embryo sac of Brongniart is not composed, as in the Gymnosperms, of a single cell; it results on the contrary from the blending of at least two cells superposed and originally separated by partitions.

2. The cells which are to compose subsequently the embryo-sac all proceed from a single primordial mother cell. M. Warming, who has discovered them, has with reason given to them the name of special mother cells, comparing them with mother cells of pollen or spores This bringing together is justified by the physical characters of the partitions.

3. When the evolution of the special mother cells has been completed, each one of them gives rise to four nuclei homologues of the four grains of pollen produced in the same mother cell.

4. The variations which I have observed in the different types of Angiosperms depend on the arrest of development more or less early which seizes the special mother cells.

5. The first cell always forms the sexual preparation. It blends itself with the second cell to thus constitute the greater part of the embryo-sac. When the second cell produces a "*tetrade*," the eight nuclei freed from the embryo sac act as M. Strasburger describes it in *Orchis* and in *Monotropa*. This fact is observed in certain Monocotyledons and dialypetalous Dicotyledons.

6. The other special mother cells (3, 4, 5) may produce some "*tetrades*." Each one of the vesicles is homologous with a grain of pollen, and it is tempting to give to it the name of antipodal. When these mother cells persist in their primitive condition without producing "*tetrades*," they themselves simulate antipodal vesicles superposed, not juxtaposed. They differ from them from a morphological point of view and I have given to them the name of *anticlinal cells*.

This condition has been observed in many Monocotyledons, certain dialypetalous Dicotyledons, and in almost all the Gamopetalæ.

7. The 2d cell appears to undergo at first an arrest of development. In this case, its nucleus becomes directly the nucleus proper of the embryo-sac, and this cell does not produce any antipodal vesicle. This fact, observed in some Monocotyledons and Dialypetalæ, becomes the rule in Gamopetalæ, which are, from this point of view, the plants most removed from Cryptogams.

8. In the Gamopetalæ (with very few exceptions), cell one alone produces a "*tetrade*," complete or incomplete, which is no other thing than the sexual preparation composed of two or three or four vesicles.

The second cell seems to perform the vegetative part of the embryo-sac. Its undivided nucleus becomes the nucleus of the embryo-sac.

The cells 3, 4, 5 (or 3, or 3 and 4, according to the number of the special mother cells) are some anticlinal, or produce the antipodal vesicles by dividing their nucleus.

9. In the greater part of Gamopetalæ, the formation of the endosperm is deferred to subsequent development, by division, of one or several of the special mother cells. These last being homologous with the mother cells of spores, it is legitimate to consider the endosperm of these plants as a sterile female prothallus.

BOTANICAL CONTRIBUTIONS, by Asa Gray. Issued September 1, 1880.—These annual contributions to North American Botany are always greeted with the greatest interest by systematic botanists, and the pages can hardly be cut and run through hastily enough to satisfy their eager curiosity. What new species and genera have come into the world and what have departed this life, are questions that first occur. This paper is largely devoted to recording some of the results of Dr. Gray's elaboration of the vast order Compositæ for his Synoptical Flora. As this portion of the Flora cannot be published at once, botanists are under very great obligations for some of the "ad-

vance sheets," containing the results of work upon some of the most perplexing groups. We will note some of the most important things in passing, merely giving what would catch a botanist's eye in turning over the pages In VERNONIA the principal change from Torrey and Gray's Flora is the restoration of *V. altissima*, Nutt., standing between *V. fasciculata* and *V. Baldwinii* or *Noveboracensis*. A new species appears under the name of *V. Lettermanni*, Eng., from Arkansas.

Aplopappus integrifolius, T. C. Porter, is taken up from an unpublished name of a plant collected by the writer in Wyoming in 1872, and three new species are added.

SOLIDAGO is divided into three primary sections or subgenera, viz.: *Virgaurea*, *Euthamia*, and *Chrysoma*. The *Chrysastrum* section of Torrey and Gray is reduced to a subsection of the first, and is made to include *S. petiolaris*.

The southwestern genus APHANOSTEPHUS has now five recognized species which Dr. Gray arranges and characterizes.

A new genus of the Asteroideous Compositæ is proposed under the name of GREENELLA, in honor of Rev. E. L. Greene, and the single species is *G. Arizonica*.

CHÆTOPAPPA, DC., is made to include *Distasis*, DC. The Rocky mountain genus TOWNSENDIA which has so long perplexed us appears fresh from Dr. Gray's hands in the form of a most satisfactory synopsis, and 3 or 4 new species are added. The genus now contains 17 species.

Then follows a synopsis of the genus ERIGERON, which "shades off into *Aster* in more than one direction; and its subgenus *Cœnotus* fairly runs into *Conyza*. It can be limited only by taking into account a combination of characters, and insisting here upon one, there upon another. The general differences between it and *Aster* are found,—1. in the simpler involucre, of equal neither foliaceous nor appendiculate narrow bracts; 2. in the very numerous and narrow rays of the typical species; 3. in the very short, broad, and obtuse style-appendages; 4. simpler stems, naked above or with few more pedunculate heads; 5. less copious and more fragile pappus; 6. smaller achenia; their nervation is of less importance, but mostly there are only the marginal nerves." The three primary sections are *Euerigeron; Trimorphæa*, and *Cœnotus*, the first containing 51 species, the second 3, the third 5.

"ASTER. The revision of this vast genus is not yet completed, owing to the great difficulty which is experienced in settling the synonomy and the limits of some of the earlier as well as of the later known species. It is intended to accept the genus in the wide extent assigned to it in the Genera Plantarum of Bentham and Hooker, at least so far as North America is concerned, and also to include *Brachyactis*. The subgenera may be arranged in two series; the first of perennials, the second of annuals and biennials; and an endeavor has been made to dispose of the perennial Asters under the following subgenera: AMELLASTRUM; MEGALASTRUM, which connects the genus

with *Townsendia*; HELEASTRUM; HESPERASTRUM, containing but a single species, *A. Shastensis*; BIOTIA; EUASTER, or Aster proper; DŒLLINGERIA; IANTHE; ORTHOMERIS. The annual and biennial Asters are grouped in the following subgenera, OXYTRIPOLIUM, CONYZOPSIS, and MACHÆRANTHERA. Among the true Asters are several forms which become species, as *A. Porteri* for *A. ericoides*, var. *strictus* and *A. Pringlei*, from the northern end of Lake Champlain.

A new genus of *Asteroideæ* is proposed under the name of GUNDLACHIA, a West India plant which had been wrongly referred to *Solidago*. Other new Compositæ named belong to the genera *Chænactis*, *Actinolepis*, *Laphamia*, *Fleischmannia*, *Eupatorium*, and *Philactis*.

The second part of the paper contains descriptions of some new species of ASCLEPIAS. Three species from southern-western United States are named by Mr. E. L. Greene, and three from Mexico by Dr. Gray.

The third part describes a new genus of *Gentianaceæ*, and names it GENIOSTEMON, Engelm. & Gray. It contains two species, both of them Mexican.

Part four contains "Miscellaneæ of the North American Flora." Of course there is a new *Astragalus*, and it bears the name of its discoverer, Mr. E. L. Greene. A species of *Sedum* from near Salt Lake City bears the name of our good friend, Mr. Thos. Meehan. It was collected by Mr. John Reading, the live plant being communicated by Mr. Meehan. In dedicating it Dr. Gray pleasantly remarks, "It is so desirable to connect in this way the name of Mr. Meehan with the botany of the country which he has done so much to illustrate, that the actual collector will probably join us in wishing it to be commemorated by this pretty little species of *Sedum*. It will not make much show among Meehan's "Flowers of the United States Illustrated," of which four goodly volumes have already appeared under his editorship; but it is to be hoped that it will find a place in the fifth volume.

A new species of *Douglasia* is described from Mount Hood, Oregon, having been collected by Joseph and T. L. Howell. *Gilia depressa* is decribed by Marcus E. Jones from southern Utah.

A new genus of *Euphorbiaceæ* from Arkansas and Texas is described under the name of REVERCHONIA, in honor of M. Julien Reverchon, of Dallas, Texas. "The relationship of this plant to *Phyllanthus* is so close, that, were it not for a combination of characters, it might be taken for an aberrant *Phyllanthus*."—J. M. C.

GAZETTE FOR JANUARY, 1880.—If any readers of the GAZETTE have duplicate copies of Vol. V, No. 1, we would be glad to buy them at the regular rates.

Botanical Gazette.

Vol. V. OCTOBER, 1880. No. 10.

FENDLER'S FERNS OF TRINIDAD.—Sets ranging from 25 species to 68, supplementary to the sets distributed in 1878, are now for sale at New Haven. A few sets of the first distribution are still to be had. The additional numbers and names are appended.

D. C. EATON.

12. Asplenium pumilum, Swartz
38. Polypodium decumanum, Willd.
39. Asplenium cicutarium, Swartz.
44. Polypodium piloselloides, L.
49. Alsophila blechnoides, Hook.
50. Polypodium lycopodioides, L., var. salicifolium, Hook. & Baker.
56. Selaginella ciliauricula, Spring.
59. Acrostichum (Olfersia) cervinum, L.
64. Trichomanes membranaceum. L.
65 Aspidium conterminum, Willd., var. strigosum, Eaton. (Aspidium strigosum, Fee).
67. Pteris aculeata, Swz.
72. Lycopodium cernuum, L.
83. Polypodium loriceum, L.
85. Polypodium chnoodes, Sprengel.
87. Trichomanes crispum, L.
88. Meniscium reticulatum, L.
90. Polypodium fraxinifolium, Jacq.
91. Trichomanes rigidum, Swz.
92. Trichomanes spicatum, Hedw.
94 Polypodium piloselloides, var. moniliforme, Hook.
96. Asplenium salicifolium, L., Hooker.
96B. Asplenium auriculatum, Swz.
97. Aspidium Imrayanum, Fee. (Nephrodium Imrayanum, Hook., referred to Polypodium (Phegopteris) flavopunctatum by Baker, but these specimens have a well-developed indusium).
99. Asplenium serratum, L.
100. Hymenophyllum polyanthos, Swz.
101. Acrostichum nicotianifolium, Swz.
102. Hemitelia multiflora, R. Br.
103. Polypodium crassifolium, L.
105. Acrostichum (Polybotrya) caudatum, Hook.
106. Acrostichum (Stenochlæna) sorbifolium, L., var. Yapurense. (Acrostichum Yapurense, Martius.)
107. Lycopodium Aqualupianum, Spring.

112. Alsophila nitens, J. Smith. Pinnæ somewhat less scaly beneath than in No. 32.
115. Vittaria lineata, Swz.
116. Tœnitis angustifolia, R. Br.
117. Polypodium Phyllitidis, L.
118. Aspidium plantagineum, Griseb.
121. Acrostichum sorbifolium, L. The typical form, very nearly.
122. Acrostichum (Chrysodium) aureum, L.
124. Acrostichum Lingua, Raddi.
125. Aspidium falciculatum, Raddi.
126. Acrostichum luridum, Fee.
129. Danæa nodosa, Smith.
130. Asplenium marginatum, L.
131. Polypodium jubæforme, Kaulf.
132. Gymnogramme pumila. Anton Sprengel.
133. Blechnum serrulatum, Richard.
134. Trichomanes Bancroftii, H. & G.
135. Schizæa pennula, Swz.
136. Tœnitis furcata, Willd
137. Hemionitis citrifolia, Hook.
138. Schizæa elegans, Swx.
139. Asplenium obtusifolium, L.
140. Asplenium rhizophorum, L.
141. Asplenium celtidifolium. Mett.
142. Alsophila sagittifolia, Hook.
143. Trichomanes pyxidiferum, L. (Tr. Brasiliense, Grisebach).
145. Trichomanes muscoides, H. & G.
146. Selaginella flabellata, Spring.
147. Danæa alata, Smith.
148. Hypolepis repens, Presl.
149. Pteris gigantea, Willd.
151. Antrophyum Cayennense, Kaulf.
151B Antrophyum subsessile, Kunze.
153. Acrostichum Lingua, Raddi.
154. Aspidium cicutarium, Swz.

18, of the first distribution, is Aspidium invisum, Swartz, rather than A. patens, to which it was referred in the former list.

22. is nearest to Aspidium Sprengelii, Kaulf, and may perhaps safely be referred to that species.

23. Hypoderris Brownii, J. Smith, and not Phegopteris dracunoptera, to which it bears a close general resemblance.

80. Cyathea Schauschin, Martius. Mr. Fendler has sent a fine caudex of this plant, which completes the proof of its identity with a species now known to be widely distributed in tropical America.

Two undescribed North American species of Septoria, by F. de Thuemen.—Septoria albaniensis Thuem. in *Mycotheca universalis* No. 1294.—S. maculis in folii pagina superiore irregularibus,

saepe confluentibus, magnitudine varie, subarescentibus, ochraceis, subconcolori vel fusco marginatis, in pagina inferiore e contrario indeterminatis, ochro-griseis, obscuriore cinctis; peritheciis hypophyllis, sparsis, minutis, punctiformi-sublenticularibus, atris, pertusis; sporis bacillaribus vel cylindraceis, utrinque subrotundatis, curvulatis, uni septatis, hyalinis, 30–32 mm. long., 2.5 mm. crass.—A *Septoria salicicola Sacc.* in Michelia I. p. 171. (*Depazea salicicola Fr.*) cum sporis 40–50 mm. long., 3 mm. crass., triseptatis et *Septoria Populi Desm.* cum sporis 45 mm. long., 3 mm. crass., sporarum magnitudine et ab prima septatione longe diversa.

Albany, New York, ad *Salicis lucidæ Muhl.* folia viva. Aug. 1878. Leg. Ch. H. Peck

Septoria Querceti Thuem.—S. peritheciis hypophyllis, numerosissimis, densissime gregariis, minutis, nitido-atris, immersis, epidermide pustulæformi tectis postremo vix liberis, punctiformibus, maculas plus minusve suborbiculatas, translucentes efficiens; sporis numerosis, subrectis vel arcuatulis, cylindraceis, utrinque obtusatis, bi-quadriseptatis, multinucleatis, hyalinis, 18–22 mm. long., 2.5–3 mm. crass.

Aiken, Carolina australis, ad *Quercus tinctoriæ Willd.* folia subviva vel arida. No. 2227. Leg H W. Ravenel.

Quercus Leana, Nutt.—In an article on the "Oaks of the Potomac side" which I contributed to *Field and Forest* for October and November, 1865, occurs the following remark: "Two trees which I have recently discovered in a wood near the northwestern (northern) corner of the District of Columbia, have proved unusually interesting. That these should be called *Quercus Leana* and not *Q heterophylla* I maintain for the following reasons: Their resemblance to *Q heterophylla* as it exists in the herbarium of the Department of Agriculture is not sufficiently close to warrant this name, the leaves being broader and less lobed They *do* agree substantially with the specimens of *Q. Leana* in that herbarium. They also agree remarkably well with the tree which Mr. W. R. Smith, Superintendent of the U. S Botanical Garden has raised in his grounds from an acorn of *Q. imbricaria*. Finally, on considering the locality in which these trees were found, it seems impossible to believe that *Q. Phellos* can have entered into the combination. In the entire wood where they are situated not an individual of that species exists. It is wholly wanting throughout the region of Rock Creek on which the grove is located. On the contrary the prevailing oak there is *Q. imbricaria*, although both varieties of *Q. coccinea* are also frequent. It cannot therefore be justly claimed that this new discovery constitutes a revival of the famous Bartram's Oak since this was decided on the highest authority to be either a form of *Q. Phellos* or a union of that species with *Q. coccinea* var. *tinctoria*. It is, however, none the less a botanical curiosity."

Since the above was published I have re-visited the locality no less than five times and have succeeded in obtaining an abundance both of fruiting and flowering specimens, of which I may say, *en passant*, I have a supply for distribution and exchange. My latest visit was

made a few days ago, this time in company with Dr. George Vasey, Botanist of the Department of Agriculture. As there has been of late a perhaps somewhat healthy reaction against the hybrid theory, doubtless too often invoked in explanation of aberrant and intermediate forms, I will briefly describe our conjoint observations upon the oaks in the vicinity of the trees to which reference has already been made. Our problem was if possible to satisfy ourselves whether these oaks were really hybrids and if so what species were to be regarded as their putative parents.

It should be premised that on both these trees (which I am now satisfied proceed from a single root, although separate at the base) the lower leaves differ widely from the upper ones, the former being much larger and either entire and oblong or only slightly lobed or angled at the apex, thin and green both sides. I had frequently met in that locality with trees bearing none but these large, thin, smooth, oblong leaves which I had attributed to the effect of shade upon the true *Q. imbricaria*. At no great distance from these trees were found specimens of *Q. imbricaria*, *Q. coccinea* and *Q. palustris* A little way off we came upon a spot where there stood a large and typical tree of each of these species, the three trees forming a regular triangle, and just in the the center of this triangular space there grew what appeared to be another double tree somewhat smaller than that which I have so often visited. I had frequently seen these before and observed that they bore the large and thin, smooth leaves with the outline of those of *Q. imbricaria*. We now observed that the larger of the two trunks bore leaves resembling the lower leaves of our *Q. Leana*, i. e. mostly lobed or angled at the end. On looking carefully up into the tops of these trees manifest signs of lobation were visible in the leaves even of the smaller trunk. This was, however, confined to the apex and often amounted to nothing more than an irregular obtruncation. On the larger trunk the leaves were very decidedly lobed among the upper branches quite clearly approaching those on the fruiting branches of the typical *Q. Leana*. As neither of these trunks had as yet commenced bearing fruit it seems very probable, as Dr. Vasey remarked, that at their maturity the leaves of these trees will assume the normal form of the hybrid.

The fact that *Q. palustris*, which was present, belongs to so distinct a group of oaks, with the shallow cup, seems to be tolerably conclusive against this hybrid having sprung from the union of that species with *Q. imbricaria*, and the only remaining explanation makes these trees a cross between the last named species and *Q. coccinea*, which was the conclusion at which I arrived on first discovering the other pair, and which is expressed in the paragraph quoted at the outset.

Recurring now to the question whether these trees are really hybrids or not, it seems as if no rational mind, brought into actual contact with the facts as they presented themselves in their plain, straightforward way, could resist the conviction that the pollen from a lobed-leaved form had fertilized the stigmas of the entire leaved form, or

vice versa, and that these variable, intermediate, and unstable states had sprung from acorns thus crossed. And this is the consideration which I wished specially to emphasize. It is often and truly said that persons unfamiliar with any special branch of natural science are incapable of appreciating the nature and force of scientific convictions. This would be pre eminently true in this case. Standing in the presence of these forest denizens, I felt that they were speaking to me and revealing to me the secret of their conception, birth and life, in a language more potent and convincing than any words or voice could make it.—LESTER F. WARD.

TIMBER LINE IN THE SAWATCH RANGE.—That part of the main range of the Rocky Mountains known as the Sawatch Range has a general north and south direction with spurs running east and west between which the different streams find their way into the Arkansas or Gunnison Rivers.

The direction of the spurs and range is important, as by it the height of the tree line is in great part determined.

Timber line is generally at an altitude of nearly 12,000 feet above sea level, but in some localities may be lower than 11,000 feet. *Picea Engelmanni* forms the great mass of the forest at high altitudes, sometimes *Pinus aristata* is quite plenty and in some places there are a few trees of *Pinus flexilis* and rarely the Aspen comes to be a member of the high alpine woods.

Close to timber line are found the largest trees and most magnificent forests of Engelmann's Spruce and there is not the gradual decrease of size and vigor that the cold of an arctic climate should cause.

A few steps and one passes from a dense forest to a treeless region extending to the summits.

Engelmann's Spruce will not grow on the rocky slides so common in the Rocky Mountains, nor in a very wet location, but an excess of moisture does not influence the altitude of timber line.

Most of the summits of the very high peaks, such as Antero, Ouray and Princeton, are nearly clean rock, surrounded by "slides," and their tree line is determined by conditions of soil; and many of the lesser peaks also have an apparent tree limit caused only by rocky summits.

The scattered trees finding a foot hold on the steep sides of such peaks, not having the protection against the elements, that in a forest one tree gives to another do not grow at as high an altitude as the soil would permit. The main agents in preventing the forest from crossing the "divides" are the snow and wind.

Some idea of the power of snow at high altitudes may be imagined by noticing the paths of the "snow slides," or avalanches, swept clean of trees from the summit to the base. At one place near Mt. Antero, where an avalanche had come down, the trees from the mountain side were piled up twenty feet high for a distance of five hundred feet. Near tree line, where there has been no downward

movement of large masses of snow, I have seen trees six feet high torn up by the drifts. Large drifts are generally formed near the summits of steep banks about timber line and easily prevent trees obtaining a foot hold upon the steeper slopes. If such a slope at its summit has a comparatively level area protected by a higher summit some distance beyond, there will be a sort of double timber line, one at the foot of the bank and one some distance beyond its summit, but the upper one is formed by trees, almost prostrate, bent and twisted downward and distorted into all manner of shapes by the weight of the snow. They owe their existence to the nearly level habitat which prevents them from being torn up by a downward motion of the snow. Without a higher protecting ridge this second timber line would be impossible on account of the winds which would keep the summit clear of trees.

The prevailing winds are from the west from which direction the snow is drifting almost continuously throughout the winter. On almost any clear winter day the banners and streamers of snow can be seen coming from the summits. In consequence of the prevalence of western winds, the largest drifts are on the eastern slope and on the eastern slopes of north and south spurs and timber line is higher on western slopes. This is plainly seen upon the smaller spurs having a north and south direction. If the soil and slope are the same upon both sides, the tree line will round the spur from the western exposure and fall on reaching the eastern slope five or more hundred feet. The wind storms are most violent on the high ridges and divides and prevents the growth of trees in such places, but their direct destructive influence reaches only two or three hundred feet each side of the summit and a lower limit to the forest is due to the drifting snow. Sometimes but rarely a line of prostrate trees between wind and snow can be found, just over the summit out of reach of the wind and not far enough down the slope to enable the drift to obtain a hold and uproot them. *Picea Engelmanni* does not record in its growth the direction of the wind as *Pinus aristata* sometimes does in exposed situations when the twisted and turned branches plainly show that the prevailing winds are from the west. The limit of trees being determined by the winds and the snows drifting about the summits, then timber line depends very much upon the height of the dividing ridge and the higher the mountain the higher the tree line, other conditions being the same.

Timber line reaches its highest altitude where there is a large area of high elevation extending long distances from dividing ridges. —T. S. Brandegee.

Notes on some Californian Plants.—A residence of a year and a half in the Southern part of California, principally in the neighborhood of Los Angeles, has enabled me to study and collect the plants of that region, and I propose giving the readers of the Gazette some account of a few of the most interesting features of the vegetation of that locality. I shall select for my purpose only the more

remarkable and interesting forms of vegetable life, and those which are not known to the east of the mountains.

Eschscholtzia Californica, Cham., the Californian Poppy, is one of the commonest plants in some localities. Where it grows in large patches, as it very frequently does, the blossoms make the ground appear of a most intense golden color, and when the sun is shining brightly upon them, the eye is dazzled by the blaze It is a very variable species, and its synonomy as given in "Watson's Index" is very large. It does not seem to occur at all east of the Wasatch mountains, but is very common in California, especially in the neighborhood of Los Angeles.

Platystemon Californicum, Benth. A species peculiar to California, and commonly known as Cream Cups, from the color and shape of the flowers. These are quite large, at the top of naked hairy peduncles. The leaves are all linear and mostly radical. It is very common near Los Angeles.

Thysanocarpus curvipes, Hook. Remarkable for the curious pods which terminate the slender, drooping pedicels. The flowers are small, white and inconspicuous. One of the forms has the wing of the orbicular pod perforated, and it is, therefore, known as the Lace pod. It grows on rocky banks and in dry soil

Isomeris arborea, Nutt. This is another strictly western plant. It is a tall half woody shrub, with three parted leaves, clusters of yellow flowers, and inflated bladdery pods. It belongs to the *Capparidaceæ* and is quite common near San Diego, and on the Colorado desert.

Sidalcea malvaeflora, Gray. Found as far east as Colorado. It grows tall and slender; long petioled, crenate, heart shaped leaves, and flowers large, bright purple, and arranged in a loose raceme.

Erodium moschatum, L'Her., and *E. cicutarium*, L'Her. The former of these two species is the more common, and is of a larger and more vigorous growth than the latter. The seeds are the most remarkable feature of the plant, and these I have described in the GAZETTE for September, 1879. The common name of Pin Clover is given from the seeds.

Schinus Molle, Linn. The Pepper Tree. This is one of the shade trees of Southern California, and is one of the prettiest of trees. The flowers are small, greenish white in long racemes. The fruit is globular, of a deep red color, and hangs in long bunches, contrasting beautifully with the pinnate leaves. It is hot and peppery to the taste, and in Mexico, where the tree is native, it is known as Chili pepper. From the broken leaves and branches exudes a white gummy substance, which is also peppery. Generally not very tall, it branches some eight or ten feet from the ground. The bark is rough and scaly, but the long pendulous branches and pinnate leaves are handsome. Blossoms twice a year, and is an evergreen, the branches never being bare of leaves. It is extensively planted in Southern California, but the climate of San Francisco is not very suitable for its full development.

Rhus diversiloba, Torr. and Gr. is the Poison Ivy or Oak of Cali-

fornia, and is very similar in appearance to the Rhus Toxicodendron, L., and seems to be even more poisonous. It is either an erect or climbing shrub, with three parted crenate leaves, and small clusters of greenish flowers. A preparation of *Grindelia robusta*, seems to be efficacious in curing the poison. Another species, *R. aromatica*, Ait. is sometimes mistaken for *R. diversiloba*, and is said to effect some people in the same way.

Lupinus rivularis, Dougl. This is one of the handsomest of all the Lupines. Tall and stout in habit, it has large, long petioled leaves, smooth and bright green. A dense spike or raceme of bright blue flowers is at the summit, and it adorns in profusion the zanjas or ditches near Los Angeles.

Medicago sativa, L. The Alfalfa or Lucerne of the farmers This has been introduced from Australia, and forms one of the most valuable pasture plants of California. It grows very rapidly and is often cut four and six times in a season. Once planted and well rooted a field is said to last for 30 years. The roots penetrate so deeply into the soil that they find sufficient moisture for their nourishment without irrigation *M. denticulata*, Willd., is the Bur or Sheep Clover. It has small yellow flowers, but its chief value is in the burs which afford good nourishment for sheep when all other feed has disappeared from the ground.

Adenostoma fasciculatum, Hook and Arn. This is the celebrated greasewood we are told so much about and which forms nine-tenths of the vegetation in many parts of the mountains. It is a bushy shrub with awl shaped leaves, and close clusters of white flowers. The roots are extensively used for fuel, and its presence on land is a sure indication of water at no great depth.

Heteromeles arbutifolia, Roem. A very pretty small tree, with crenate coriaceous, bright green leaves, and clusters of white flowers. In the fall the red berries hang on the tree in great profusion, forming large bunches and looking in the distance like apples.

Saxifraga Parryi, Gray, is strictly a Californian species, and is a very pretty one. It springs from a bulb, and the short stalk has hairy radical leaves, and is surmounted by a small cluster of white flowers. It grows in profusion in dry rocky sod near San Diego.

Jussiæa repens, var. *Californica*, Wats. I mention this plant to say that I found it growing in San Juan Canon in the water from some hot sulphur springs. The plants were growing in water which was uncomfortably hot to the hand. Again I have seen them growing in the mud on the Los Angeles River.

Godetia Bottae, Spach. This is a fine species of the genus and has very large, handsome purple flowers. It is peculiarly a western form and is very common in good soil near Los Angeles.

Megarrhiza Californica, Torr., is a close relative of *Echinocystis lobata*, Torr, and Gray, and has much the same habit of growth. It climbs over brushes and shrubs and its long racemes of white flowers, or the large spring fruit look very pretty in the bushes. The

fruit always opens at the top, and as this hangs down, the seeds drop out as soon as ripe. The tendrils are long and sensitive.

The *Umbelliferae* and *Compositae* are very well represented in California, but not having yet determined many of them I leave them for another time.

Arctostaphylos glauca, Lindl., is the Manzanita of the mountains. Generally speaking it is a small tree or shrub, with very crooked branches. The wood is very hard and tough, and of a deep red color. The flowers are of a rose white, and in open racemes with very sticky pedicels, and the leaves are thick and coriaceous It grows plentifully in some places in the mountains.

Styrax Californica, Torr. This is a small tree with rough crooked limbs, white bell shaped pendulous flowers, and tomentose leaves. It belongs to a genus which has but few representatives in the United States, and which is by no means common. Its favorite locality is on the sides of the mountains, in the damp canons; and even here it is not plentiful

Gilia Californica, Benth This is one of the commonest species of this extensive genus. It forms a small bush growing on the mountain side. The leaves are awl shaped, and sharp pointed, while the flowers are quite large, funnel shaped, and of a lilac or purple color. It is one of the best marked, and most peculiar of all the species of *Gilia*.

Gilia intertexta, Steud., has small white flowers, and grows spread out like a mat on the ground, the leaves being bipinnate.

Gilia multicaulis, Benth., with the var. *tenera*, Gray, is very common in California. The stem is simple and low, with a few finely dissected leaves at the base, and a bunch of violet flowers at the top of the stalk. The variety generally has but a single bloom, and comes out very early in the season.

Heliotropium Curassavicum, L. This is a handsome bright green plant, with scorpioid terminal racemes of white flowers, the whole plant invariably turning black when dry. It is very common in damp or moist soil.

Phacelia ramossissima, Dougl., *P. tanacetifolia*, Benth. and *P. hispida*, are all closely related and often hard to distinguish from each other. The last can be known by its globular capsules and long calyx teeth. The flowers of all of them are blue or bluish, arranged in recurved one sided racemes, while the leaves are all dissected.

Eriodictyon tomentosum, Benth. A tall shrub with thick crenate very tomentose leaves. Flowers blue, in a loose spike. Another species of this genus, *E. glutinosum*, Benth., is called by the Mexicans "Mountain Balm" or "Yerba Santa," and is very much prized by them as a medicine. *E. tomentosum* is said to be an excellent remedy for bronchial troubles, and also for asthma. I have been told by several persons that it benefitted them greatly. The leaves are made into a sort of weak tea and the patient drinks it when he feels like it.

Nemophila insignis, Dougl. One of the prettiest of the wild flowers. It is a small low plant, with a bunch of bright blue or purple

flowers at the top of the stem, and with pinnatifid leaves at the base.

Nicotiana glauca. A small tree growing very plentifully in Los Angeles. The leaves are large, very smooth and glaucous Branches of a light green, with small clusters of yellow, tubular flowers. It seems to blossom all the year round, and its favorite place of growth is on the banks of zanjas in cultivated or waste ground. Perhaps introduced. Not given in the Flora of California.

Datura meteloides, DC. A splendid species of the genus. The flowers are often eight inches in length and four or five in diameter. The corolla is of a creamy white, with quite an agreeable odor. The plant forms a small bush three or four feet high, and though regarded as a common weed, it is well worth the attention of gardeners.

Abromia maritima. A very handsome plant, growing in mats close to the ground. It is clammy pubescent all over, and the flowers are in close umbels, and of a bright purple. What makes it seem prettier than it otherwise would, is perhaps, the fact that it grows in barren sandy places, and the flowers contrast beautifully with the dry sand.

Platanus racemosa, Nutt., is the representative of the sycamore of the east. It has much the same habit of growth, and general appearance, but the leaves are three to five cleft instead of being toothed. The wood is so hard that it will often turn the edge of an ax or hatchet. It grows to be one of the largest trees of Southern California, and one in the yard of a brewery in Los Angeles must be between 30 and 50 feet in circumference. A specimen of *P. occidentalis* is mentioned in the GAZETTE for June which is 48 feet in circumference.

Quercus agrifolia, Nee, the Live Oak of California is the relative of *Q. virens*, the Live Oak of Florida. It is found in the canons of the mountains in the south and also all over the San Joaquin valley. The leaves are evergreen, coriaceous, and with sharp pointed serrations. It branches quite low down and in open ground like the San Joaquin valley, its top is rounded and symmetrical, forming a crown fit to grace the lawn of a nobleman. It grows very large. For I measured one which was 21 feet in diameter, 3 feet from the ground.

Anemopsis Californica, Nutt. A marsh plant, with ovate leaves, and flowers in a dense spike, with an involucre of white leaves. The Mexicans make a salve of the bruised leaves and use it to bring down the swelling of bruises and sprains.

Yucca Whipplei, Torr., is very handsome. The flower stem is often ten feet high and is covered for about one half its height with a dense mass of bell shaped white flowers. The leaves are long, serrulate, and with hard sharp points. When they get old they become frayed at the edges, hanging in long filaments on each side.

Calochortus splendens, Dougl., is well named. The flowers are large, open cup shaped, situated on long peduncles, and of a bright blue, the petals fringed on the inner side with numbers of yellow hairs. At a distance it is a very striking plant.

Polypodium Californicum, Kaulf., is similar to *P. vulgare*, L., but

of larger growth. Common in canons where there is plenty of shade and moisture.

Gymnogramme triangularis, Kaulf. Commonly known as "Gold backs," from the golden color of the spores. Grows in crevices of rocks and is a great favorite in cultivation.

Notholaena Newberryi, Gray. Sometimes called "Silver Fern," as it is very white and tomentose underneath. It grows from four to six inches high on the mountain side.

Adiantum emarginatum, Hook. Larger than *A. Capillus-Veneris*, L., and with the segments of the fronds not incised. Common in canons in damp places.

Woodwardia radicans, Smith. A very imposing fern growing from four to six feet high in large clumps. Common along streams in shady canons. — Jos. F. James, *Cincinnati*.

"Systematic Fern-List."—A classified list of the known ferns of the United States of America, by Daniel C. Eaton, New Haven, Conn. September 7, 1880. First edition.

This neat and timely "Fern-List," by the author of the "Ferns of North America," is most welcome, and will be warmly received by all fern students. The species and genera are arranged in tribes and the geographical range noted. All the recent additions, including *Notholæna nivea* (for which New Mexico should be added to the range) and *N. Lemmoni*, discovered since the completion of the two volumes of Ferns of North America, are given.

The List is designed for exchanges, and will not only serve its purpose admirably, but help to familiarize students with the changes in nomenclature adopted by the author in his fern book, although the necessity for some of them is certainly to be regretted.

It was so much easier, for example, to write *Ophioglossum bulbosum* than *O. crotalophoroides!* and then Michaux's name had become so well established, and was, withal, so exceedingly appropriate that it seemed a pity to disturb it. But the law of priority is inexorable, and we must write Walter's name whether we like it or not. It may not be out of place here to state that the recent collection of two very distinct forms of *Asplenium myriophyllum*, by Miss Reynolds, makes it almost certain that we shall have to recognize the presence of *Asplenium rhizophyllum*, Kunze in Florida, and reduce *myriophyllum* to the rank of a variety of that species with Hooker. I have the authority of Mr. Baker for saying that Miss Reynolds' two forms represent those two ferns as they have them in the Kew Herbarium, thus rendering this further change in our nomenclature probable.

Hooker here, as in the larger work referred to, is given as authority for *Aspidium spinulosum* var *dilatatum*, but it appears from some notes published in the Canadian Naturalist, by D. A. P. Watt, of Montreal, that *Aspidium dilatatum* was first reduced to a var. of *spinulosum* under *Polystichum* in "Hand-book i Skandinaviens Flora," p. 398, by Hartmann, and the name *Aspidium spinulosum* var. *dilata-*

tum first given by Hornemann in "Nomenclatura Floræ Danicæ," p. 33–1827. So that, if this be correct, the latter's name should stand as authority.

The List gives 151 species as recognized by the author; a remarkable increase in the number of species since the appearance of Mr. Edwards' Check List in 1874, but as one of these (*Cheilanthes argentea*) is doubtful, and the claim of *Phegopteris calcarea* to specific rank is a questionable one, the number of well established species might be reduced accordingly.

The author states in his "Note" that copies may be obtained of him at the price of ten cents for single copies, or one dollar for fifteen copies, or that it will be sent in exchange for good specimens of rare or interesting ferns.

The list is to be commended as being the best classified arrangement yet published, and as showing how exact and reliable our fern literature is becoming.—G. E. D.

We notice with pleasure that the corporation of Brown University has at last established a Botanical Professorship in compliance with the wish of the late Stephen F. Olney, who left $25,000 for this purpose. Until a competent Profess r can be appointed, Mr. W. W. Bailey, who has been for some time instructing classes in Botany, has been appointed Instructor. We should think that the corporation might go farther and fare worse than to appoint Mr. Bailey Professor.

Mr. Olney's herbarium has been deposited in the L brary building and will be hereafter known as "The Herbarium Olneyanum."

The Gazette for 1881.—We would call attention to the advertisement printed on the last page of the cover. It is time now for the patrons of the Gazette to begin to use their friendly influence for the coming year. As our circulation is rapidly increasing it becomes more of an object for contributors to place in our hands whatever they desire to be read not only by the botanists of this country, but of Europe. Articles for the coming year should be under preparation and sent in as soon as possible that from a large assortment of material the selection for each number may be as varied as possible. Botanists' tastes do not all run in the same directions, and if any subscriber, looking over a number of the Gazette, comes to the conclusion that there is nothing in it to suit his fancy, he should feel it to be his duty to sit down and write something to his liking, for there will undoubtedly be other readers like himself. If this plan was adopted, every number would contain something of interest to every botanist. We would also call attention to our offer in regard to furnishing plates wherever such seem necessary to the proper understanding of any article. Of course the publication of such papers would be more or less delayed.

HERBARIUM
NEW YORK

Botanical Gazette.

Vol. V. NOVEMBER, 1880. No. 11.

EDITORIAL.—DR. GEO. THURBER, the distinguished botanist, so well known from his work in the *Gramineæ*, sailed for Europe Sept. 2nd. We understand his object is a study of the various Experimental Stations in France, Germany and England, in the interest of progressive agriculture.

FERNS OF NORTH AMERICA.—Since the issue of the last part (No. 27) of Prof. Eaton's great work, bearing the above title, several species have been discovered, either entirely new, or new to this country, and a considerably larger number are likely to be found in the future. Many of the subscribers have urged the publisher, Mr. S. E. Cassino, to issue new parts from time to time as new species are discovered; these supplementary parts in time to constitute Vol. 3. This will be done if a sufficient number of subscribers agree to to continue. The price and style of the work will remain unchanged. Probably not more than from 2 to 4 parts will be issued per year. Those wishing to aid in keeping this great work abreast of the times should send their names immediately to the publisher, S. E. Cassino, 299 Washington St., Boston, Mass.

A LETTER FROM BARON EGGERS informs us "that the first set of 100 species of dried West Indian plants is now ready for distribution, as are also sets of fruits and seeds, and of woods (cross sections of stems 10 centim. long) and arboreous vines. The following very low prices have been fixed, and we take pleasure in making them known to our subscribers:

100 dried plants,	$8.00.
100 species fruits and seeds,	7.00.
100 species woods,	16.00.
50 species arboreous vines,	16.00.

Of the arboreous vines, each species is represented by 10 pieces of the stem, 25 centim. long, of various thicknesses. Transportation is prepaid. Subscriptions for any of the above sets will be received by the Curator of the Botanical Museum at Harvard University, Cambridge, Mass., who will also see the collections properly forwarded.

HORTICULTURIST'S NAMES sometimes grow to as great a length as the good old names given to plants before the system of binomial nomenclature came into use. The latest addition to ornamental trees is *Acer Plantanoides Aurea variegatum Buntzleri*, or, in other words, a striped leaf maple.

PROF. MARCUS E. JONES, Grinnell, Iowa, has had the good fortune of having quite a lengthy paper (64 pp.) translated into French

and published by no less an association than the Federation of Horticultural Societies of Belgium. It is entitled "Une Excursion Botanique au Colorado et dans le Far West" and is translated by Dr. Henri Fonsny, of Verviers. Prof. Jones is collecting largely in the west and enough of his specimens have reached Europe to make him known there, and the desire to know more of the country that produces such plants has led to the writing of th s paper.

The Iowa Academy of Sciences has published a pamphlet of some 30 pages containing its procedings from August 1875, the date of organization, to July 1880. The number of Fellows cannot exceed 30, and only such persons as have done good scientific work are eligible, the assent of three-fourths of the members being necessary to a choice. From the list of Fellows given we note but two to whom some branch of botany is credited as a specialty, namely, Prof. C. E. Bessey and Dr C. M Hobby The latter gentleman publishes a list of the "Fresh Water Algæ f und in Iowa" Twenty-seven genera are represented by seventy two species, *Spirogyra* containing eighteen.

The Stem of Pumpkin for Illustrating Plant Histology.— The stem of the common pumpkin (*Cucurbita Pepo*) is admirably adapted for use in the laboratory to illustrate many kinds of cell-structures, and the larger part of the tissues of the higher plants. It is of a convenient size to be held for sectioning, and after remaining in a sufficient quantity of strong alcohol for awhile becomes very solid, so that exceedingly thin sections are easily obtained. The cells are comparatively large and a power of 250 to 500 diameters will demonstrate almost every detail.

A cross-section of the stem shows without magnification five small fibro-vascular bundles lying beneath the five angles of the stem, with the same number of much larger bundles situated between them, but deeper These are imbedded in the fundamental tissue, and the whole surrounded by a cortical rind. The center of the stem is hollow, due to rupture of the fundamental tissue from expansion by growth. Other features of the stem can be made out without a microscope, but it is best to revert to them after their full significance is understood.

An enumeration of the kinds of cells and tissues to be met with will answer the purpose of this notice, as no extended description is intended. The cortical rind is composed of epidermis and hypoderma. Three forms of cells belong to the epidermal system – simple epidermis cells, hairs, and guard cells of the stomata, the latter best studied in cross sections of the stem. The fundamental system comprises the large-celled, thin walled parenchyma in which the fibro-vascular bundles lie, and the hypodermal tissues. The parenchyma is colorless and varies little except in size of the cells. The hypoderma consists of two layers, encircling the stem, partly performing the office of imparting strength, and partly containing assimilative protoplasm. The innermost of these is of uniform thickness and made up of slender wood cells. Thin transverse septa are occasionally met with, which

are usually regarded as subsequent formations,* but may, however, be the persistent partitions of cells that generally coalesce completely to form single wood-cells.† The wall of the cells is differentiated into three lamellæ—a middle one, with one on either side—and has simple pits not penetrating the middle lamella. These pits are twisted in such a way that they have the appearance of being situated at the intersection of the arms of an oblique cross, when seen in front view. To determine their structure requires careful examination with a high power. Between the wood-ring and the epidermis lies a ring of tissues of very considerable importance, but not homogeneous like the last. It consists of parenchyma containing chlorophyll, in which lie numerous masses of collenchyma in contact with the epidermis but not extending quite deep enough to come in contact with the cortical wood. The stomata are all situated in the part of the epidermis touched by the chlorophyll bearing parenchyma, which is readily distinguished upon the exterior of the stem as interrupted lines of darker green.

The fibro-vascular bundles are open, two-sided bundles, but peculiar in having an additional phloem portion on the axial side. The xylem and the outer phloem are separated by the cambium, in which the progressive transformation from simple uniform cells to the various mature cells of each portion can be traced. Both the axial and outer phloem consist of sieve-tubes, interspersed with long, slender parenchyma cells, the two together forming "soft bast." These are excellent examples of sieve-tubes: the perforated end-partitions, the broad thin spots and sieve plates of the side walls, and the conspicuous protoplasmic contents are readily made out in detail. The xylem contains all gradations between the extreme form of annular vessels with widely isolated rings, on the one hand, through spiral, reticulated, scalariform, to pitted vessels, on the other hand. The structure of the walls of these vessels can only be studied satisfactorily under high powers. Between and about the vessels is wood-parenchyma.

To sum up the tissues of the stem of *Cucurbita*:

- Epidermal system:
  - Epidermis.
  - Stomata.
  - Hairs.
- Fundamental system:
  - Interfascicular parenchyma.
  - Hypoderma.
    - Cortical wood.
    - Cortical parenchyma.
    - Collenchyma.
- Fibro-vascular system:
  - (Cambium).
  - Phloem.
    - Sieve-tubes.
    - Phloem parenchyma.
  - Xylem.
    - Vessels.
      - Annular.
      - Spiral.
      - Reticulated.
      - Scalariform.
      - Pitted.
    - Wood parenchyma.

To these should doubtless be added laticiferous tissue sometimes

*Sachs, Text-book, p. 101.
†Bessey, Botany, p. 74.

detected in the phloem. It will be observed we have illustrations here of the three tissue systems; of all the principal sorts of tissues, except sclerenchyma. i. e., parenchymatous, fibrous, laticiferous, sieve, and tracheary tissues; with several well marked varieties of the first and second. The only prominent varieties not included are cork, bast, and tracheides, modifications respectively of parenchymatous, fibrous, and tracheary tissues. It would probably be difficult to select any one common example that more admirably illustrates tissues and tissue elements, and, withal, so simply constructed for histological study.—J. C. ARTHUR, *University of Wisconsin.*

HABENARIA GARBERI, n. sp.—Stem erect, a foot or more high, bearing at the base 1 to 2 globular tubers ½ to 1 inch in diameter, leafy; leaves oblong-lanceolate; spikes 3 to 6 inches long, loosely or densely flowered; bracts lanceolate, acuminate, about as long as the ovary; flowers greenish-yellow; exterior perigonial divisions broadly ovate, the lateral ones concave and reflexed; the two interior ones erect and 2-parted, the anterior division involute-filiform and truncate, the longer posterior one cuneate; lips larger than the perigone, entire, linear from a broad base, obtuse; spur filiform, equalling or exceeding the ovary in length, 6–9 lines.

Collected in 1878, in wet or damp hummocks, around Manatee, S. Florida, by that indefatigable and zealous botanist, Dr. A. P. Garber, for whom it is named. It blooms in the fall or winter. The flowers exhale a pleasant, verbena-like odor. It is No. 315 of Dr. G.'s. Florida collections.—THOS. C. PORTER.

NOTES FROM PROVIDENCE, R. I.—In a recent visit to Narragansett Pier, R. I., I found the species *Solidago lanceolata*, L. and *S. tenuifolia*, Pursh thronged with the lovely moth *Deiopeia bella*. One could easily have collected enough to supply exchanges for years. It was not to be seen about *S. sempervirens* which grew not far off.

I have noticed a restricted limitation of *Aster Novæ Angliæ*. L. It is not found in the immediate vicinity of our city, but about six miles north becomes very abundant on the *road-sides* and continues so in a belt to the west. One as suddenly passes out of its range. I think it grows best in the limestone region about here, where it is truly magnificent.

Mr. J. L. Bennett reports *Ambrosia trifida* L. as having appeared in our city. It is curious that it has not done so before, as at Hartford, ninety miles away, it is very common and might have been expected to follow the railway. But then while *Cichorium Intybus* is a nuisance about Boston, it is very infrequent here; its nearest approach, in quantity, is, perhaps, at Canton.

Brown University has received from the Trustees of the late Col. Olney $10,000, the income to be used for the increase of his herbarium and botanical library. A further sum of $25,000 is left to the college for a professorship of Natural History, "one of the duties of the professor being to lecture on Botany." This sum is not yet acquired.

Col. Olney undoubtedly had in view a chair similar to that occupied by Prof. Gray, at Harvard, but his wording is unfortunate for the good of our science, or indeed of any other.

The time has gone by when a composite chair of natural science is desirable or even feasible. Another unhappy oversight in the testator was his neglect to provide for the payment of a curator. A large herbarium can easily and profitably occupy a man's whole time. As the increase of the library is the function of the Library Committee, so will be the matter of addition to the herbarium.—W. W. Bailey.

Curtiss' 4th Fascicle of Southern Plants.—As I am unable to answer inquiries in regard to my next distribution, being absent from home this fall, I beg leave to inform my friends through the Gazette that Fascicle IV now in preparation and to be issued next winter, will be uniform in all respects with Fascicle III. I think, however, that the specimens will be more satisfactory, as I have a better supply of materials. My collections of 1879 suffered much from the humidity of the country in which I worked. The wonder is that they were not wholly ruined. This year I have collected mainly on the southern and western coasts of Florida, and have had excellent success. The observations I have made this year will add largely to our previous knowledge of Floridian Botany, extending and defining the range of most plants ascribed to "South Florida," including nearly all of those recently reported by Dr. Chapman through the Gazette to which I am now able to add two or three dozen more species, including three Palms and two epidendric Orchids.—A. H. C.

Notes From Racine, Wis.—Concerning Mr. Cochran's note on *Physalis grandiflora*, Hook. Dr. Lewis Sherman, of Milwaukee, Wis., informs me that he collected the plant in 1874, at Stevens' Point, Wis., which is near the centre of the State, and in about the same latitude as Mr. Cochran's station. I was interested in the articles of Mr. L. H. Bailey, Jr., but missed some plants common on the lake-shore here *Aster angustus*, Torr. and Gray, has been very abundant on and near the beach, but is scarce this season, whether, owing to the mild winter, the wet summer or some other cause, I am unable to say. *Ranunculus Cymbalaria*, L., is a common plant on the beach. *Salix Barclayi*, Anders, *S. amygdaloides*, Anders, *S. longifolia*, Muhl., *S. lucida*, Muhl. and *S. purpurea*, L., are more or less abundant on the beach and sides of the bluffs. The common grass of the the beaches here is *Sporobolus cryptandrus*, Gray. On the wet, clayey sides of a gully in the lake bank, *Trigiochin palustre*, L., and *Lobelia Kalmii*, L., are abundant. Fortunately for the root-digger, *Asclepias tuberosa*, L., grows in the sand, but is not very abundant.

The Asclepiads seem to have a tendency toward whorled leaves. Besides the species in which such an arrangement is common, I have collected *A. incarnata*, L., with a whorl of four leaves, and *A. Cornuti*, Decaisne, with leaves in both threes and fours and other specimens with very short internodes.

The length of the peduncle does not seem to be a very reliable character by which to separate *Trillium erectum*, L., var. *declinatum*, Gray and *T. cernuum*, L. The peduncles of the former are sometimes very short, while those of the latter increase in length while the flower matures. The purplish anthers of the latter, with the greater separation of the anther cells and more contracted base of the leaf are the characters I use.

I found last summer a specimen of *Trillium recurvatum*, Beck, with leaves and parts of the flowers in fours. *Barbarea vulgaris*, R. Br., seems to be perennial here.—J. T. Davis, M. D.

Stipules in Onagraceæ.—Prof. Baillon says (*Bull. mensuel, Soc. Lin. de Paris*, No. 33) that in the majority of works on descriptive botany, this family is mentioned as characterized by the constant absence of stipules, and in justification of this quotes the classical works of Decaisne, Duchartre, Endlicher and Hooker; nevertheless, he states that the existence of these organs in this family admits of easy proof, not indeed that they ever occur of large dimensions, for then they could not have escaped detection, but still they are present, more commonly as little subulate tongue-like bodies, acute, often red-colored at the base of the petioles in both opposite and alternate-leaved plants. In Hanya they soon turn black and wither off early. In the fuchsia of our gardens little stipules are often present. In Circæa they can also be detected. In the Lopezia of our gardens all the leaves have two very distinct stipules, which, indeed, have been often referred to in botanical works, and it is the same with Haloragew, though Bentham and Hooker describe them as here absent.—Nature.

Floridian Ferns.—Next winter I intend to prepare for the Gazette a list of the Ferns of Florida, with the geographical bounds of each species, which my travels in the peninsula will enable me to do pretty accurately. I expect to have ready in December a second set of Southern Ferns, and a second issue of the first set, mostly collected in different localities. I have just prepared a fourth set of Pteris collected in the heart of Charleston City. It was brought to my attention by Prof. Lewis R. Gibbes, of Charleston College, who says he sent specimens to Prof. Eaton, who pronounced it *P. serrulata*. Most of the yards in Charleston are surrounded by massive walls, which, crumbling and deeply shaded, invite the growth of all sorts of Cryptogams, and many Phaenogams. It is many years since Prof. Gibbes first noticed this form, in fact, I think he called my attention to it when there five years ago. I prepared full sets of this and three other Charleston plants, namely, *Stillingia sebifera*, *Alternanthera Achyrantha* and a Verbena, not mentioned by Chapman, a very peculiar "Vervain." I am now on my way to the Southern Alleghanies and mean to search out a peculiar Abies, which Prof. Gibbes has observed there.—A. H. Curtiss.

HERBARIUM TO BE DISPOSED OF.—I learn to my surprise that the Herbarium of the late J. T. Holton, which was carefully boxed up in his lifetime, still remains on the hands of his widow and children. It was long ago understood that his college classmates were to purchase it for four or five hundred dollars, and present it to their alma mater, Amherst College. This has not been done, and the collection could now be had by any botanist at a low price The herbarium is mainly North American, but contains the full set of the collection which Mr. Holton made in the interior of New Grenada, a great number of *Ericeæ* collected and named by Drege at the Cape of Good Hope, etc. The number of species, according to Mr. Holton's memorandum, is 6,895. Address Mrs. S. W. Holton, Everett, Mass.—A. GRAY.

(Mr. Holton also left in his library fourteen consecutive volumes of DeCandolle's Prodromus, which his widow would be glad to sell. -- ED.)

DIGESTION IN PLANTS.—Dr. Lawson Tait has recently investigated afresh the Digestive Principles of plants. While he has obtained complete proof of a digestive process in *Cephalotus*, *Nepenthes*, *Dionæa*, and the *Droseraceæ*, he entirely failed with *Sarracenia* and *Darlingtonia*. The fluid separated from *Drosera binata* he found to contain two substances, to which he gives the names "droserin" and "azerin." Dr. Tait confirms Sir J. D. Hooker's statement that the fluid removed from the living pitcher of *Nepenthes* into a glass vessel does not digest. A series of experiments led him to the conclusion that the acid must resemble lactic acid, at least in its properties. The glands in the pitchers of *Nepenthes* he states to be quite analogous to the peptic follicles of the human stomach; and when the process of digestion is conducted with albumen, the products are exactly the same as when pepsine is engaged. The results give the same reactions with reagents, especially the characteristic violet with oxide of copper and potash, and there can be no doubt that they are peptones.—NATURE.

FLORIDIAN ALGÆ.—During my recent cruise among the Florida Keys nothing interested me so much as the Sea-weeds. Being familiar with the Algae of the Pacific and Atlantic coasts, I would hardly have believed that many of these belonged to that order, but for some previous acquaintance. Their resemblance to lichens, fungi, and corals is truly wonderful. Knowing the Reef Algae to be much sought for and almost unobtainable, I collected a large quantity of specimens aud had excellent success in preserving them. They have been identified by Prof. Farlow, our best authority on Marine Algae, and in December I shall have them ready for distribution, mounted in the best manner on card board 4½ by 6½ inches in size. They will be issued in three sets, each comprising two dozen species, at three dollars per set.—A. H. CURTISS.

THE ASTERS.—I wonder if other lovers of botany have with the Asters the same trouble I am compelled to contend with? The question may seem a foolish one, but as I have seen nothing in print on the subject of complaint, I wish some of the GAZETTE readers would give me, and perhaps others, the benefit of their experience.

Of all our wild flowers the Asters seem to me to be the most aggravating to the amateur. They are attractive and beautiful as they grow where nature strews them, but when the collector comes to name his treasures, their beauty and attractiveness are perhaps lost to him in the exhibition of a little temper, or may be in one or two bad words. I might complain of the cause of this, the variability of the plants, but that is not my chief stumbling-block, although they are sometimes rough when they should be smooth, or the leaves serrate when they ought to be entire, or the other way.

I have two hand books of botany; Gray's "New Lessons and Manual," and Alphonso Wood's "Class Book." They make "confusion worse confounded" On the color of the rays, the source of all my trouble, they neither agree between themselves, nor with the flowers as I find them. Here I do not rely upon my own judgment, but upon that of my sister, who is no botanist, but whose sense of color is very acute. As examples of their disagreement let me cite the following: Wood says of *Aster ericoides*, L., "pale purple flower;" Gray, "rays white." Of *A. longifolius*, Lam., Gray says, "bright purplish-blue;" Wood, "light-blue rays." Of *A. lævis*, L., Gray says, "rays sky-blue;" Wood, "fine blue becoming purple." The list might be prolonged.

Now as to my great trouble. A specimen that I suppose to be *A. prenanthoides*, Muhl., according to the books has the "rays pale-blue." They do not seem so to me, and the question brings the reply, "light lavender." *A. cordifolius*, L. is described accurately, but with "rays pale blue" again. "What color do you call that?" is asked. "Light purple." *A. lævis*, has "rays sky-blue," says Gray. I ask my sister again, also two other persons. The three answers agree, "light-purple." If Job had studied the Asters would we not be without one of our favorite comparisons?

The reader may think that my specimens have not been correctly identified. I should think so, too, if, omitting the color and making allowances in this variable genus, the descriptions in the books did not agree so exactly with the plants themselves. Have others had the same trouble? Has any one seen a sky-blue Aster? I wish some one would rise and explain, and, as "misery loves company," that he would give us the benefit of his experience if he has suffered the same annoyance.—A. C. S., *Trenton, N. J.*

[The easiest way to dispose of this whole subject is to remember that color in flowers does not "count for much."—ED.]

DISTRIBUTION OF NYMPHACEÆ IN ARKANSAS.—While traveling through Arkansas this summer I noticed *Nelumbium luteum*, Willd. growing in ponds in Miller county on the Red River above and below

Fulton; in Pulaski county, east of Little Rock; in Pronie, Monroe and St. Francis counties, on the Memphis Railroad; in Conway, Crawford and Sebastian counties, on the Ft. Smith Railroad. It also occurs in Jefferson County, near Pine Bluffs; in Woodruff county, near Augusta, and about the headwaters of the Illinois River, north of Boston Mountains, in Washington county, northwest Arkansas.

Nymphæa ordorata grows in Saline, Jefferson and Hempstead counties, also with the former species in Washington county.

Nuphar advena is found so generally distributed through the State where I have been, I will not enumerate the localities.—F. W. HARVEY, *Ark. Ind. Univ.*, *Fayetteville*, *Ark.*

CALLUNA VULGARIS IN NANTUCKET, MASS.—This species has been found in the station indicated, and the following note from a correspondent of Mrs. Owen, of Springfield, will describe the surroundings:

The soil around the *Calluna vulgaris* seemed to be quite good; that is, not so sandy as most of our soil is, though it was not near any pond, and very little, if any, lower than the ground in the vicinity. It was, perhaps, a mile from the beach, "as the crow flies," and not much more than a quarter of a mile from a human habitation. At first we thought there were several plants, but traced their connection with each other by pushing away a little of the soil, underneath which was a stalk an inch and a half or two inches in circumference. A bushel measure would nearly if not quite cover the whole. In the center of the plants the stalks appeared dead, being without foliage or blossoms, while on the outside the stalks were covered with foliage and dried blossoms mostly, with here and there a fresh one, and new foliage was springing from the ground among the dead stalks. This was the condition of the plant Oct. 14, 1880.—L. S. RIDDELL.

CHARACEAE OF AMERICA by *Timothy F. Allen*, *A. M.*, *M. D.*, with colored illustrations from the original drawings by the author. Parts 1 and 2. S. E. Cassino, Boston.—The publication of this work was begun some time ago by Dr. Allen and a part or two being issued was discontinued. It has again been taken up by Cassino, who is gaining such an enviable reputation in the publication of scientific work, and is to be published in the same ornate way as the Ferns of North America. Each part consists of three colored plates and eight pages of text. In the first two parts received the six plates illustrated the following species, *Chara Gymnopus*, *var. elegans*, *C. crinita*, *var. Americana*, *C. coronata*, *var. Schweinitzii*, *Nitella flexilis*, *vars. nidifica* and *crassa*, and *N. tenuissima*.

In the absence of any notice or advertisement we are unable to inform our readers anything with reference to frequency of issue and price. It is handsome enough to cost a round sum but we will guarantee that Cassino has put it low enough for any botanist to buy.

FORESTRY IN NORTH AMERICA.—In the last number or two of the *Gardener's Monthly* we have been reading a translation of a paper bearing the above title and written by John Booth, Klien Flottbeck, Germany. After considering the observed evil effects of forest destruction in various parts of the United States, the writer comes to the following rather somber conclusion, which may have more of truth in it than we will care to acknowledge:

"What then are the conclusions to be drawn from the above remarks for the future of North American Forestry?

"We have seen how all authority is wanting to enforce even the simplest regulations on forestry. The only man in America who ever undertook to carry out his absolute will in this, as every other respect, was Brigham Young, who in this one matter has our decided sympathy. The communistic theory that the "forests are the property of every single American," and that he has a perfect right to cut down as much timber as he needs, is so widespread; the corruption in official circles, an unavoidable consequence of perpetual rotation in office, is so general; the necessity in which both parties find themselves of not offending the mass of voters, is so great, that we can hardly call unjustified the assertions of competent and patriotic American authorities as to the impossibility of enforcing any protective laws on forestry. In view of such conditions we can neither hope for any beneficial results from the "Commission to inquire into the European Laws on Forestry," asked for by Mr. Secretary Schurz in his annual report to the President; nor expect Professor Sargent, of Harvard, to achieve much by the three years' survey of American forests, with which he has lately been entrusted. A more competent man, or a better authority on all incidental questions, could not be found; but of what use can laws be if there exist no authority to enforce them? It is to be feared that, unless affairs take some entirely unexpected turn, the words of the Secretary of the Interior for 1877 will come true—that "in twenty years at the most, the United States will no longer be able to fill the demands for home consumption for their own forests," and that they will have to import at an enormous outlay what they might have had at a trifling expense! What the consequences will be in other respects, we have already foreshadowed; it is impossible to overrate their importance."

SOME IMPURITIES OF DRINKING-WATER CAUSED BY VEGETABLE GROWTH, by Prof. W. G. Farlow, M. D.—This paper should have been noted before, but it was accidentally crowded out of the last number. It is extracted from a Report of the Massachusetts State Board of Health, etc., and contains two plates, illustrating eight plants. It is a pamphlet that should be in the hands of every one interested in water furnished by ponds or reservoirs. There are 22 pages of it, from which we cull out here and there a passage, although it is exceedingly difficult to select in such a fragmentary way from a paper that is so complete in itself that any omission seems like mutilation.—

"The object of the present paper is to present in a popular form a statement of what is known with regard to the effect of the growth of different plants upon the water in the ponds, streams, and basins which supply the cities and towns of the Commonwealth. In this connection the subject will be discussed from a botanical point of view; and we can only consider certain striking properties, such as smell and taste, with relation to the particular species of plants which produce them, without taking into account the more subtle changes which can only be detected by chemical analysis. It is desirable that all who, in any sense, have charge of the public health, should have some familiarity with the common forms of plants, likely to pollute drinking-water; because, as the matter now stands, the public are at the mercy of any person, who, armed with a compound microscope and a supply of Latin and Greek names, chooses to alarm the neighborhood by the announcement of the appearance in the water-supplies of plants whose injurious nature is supposed to be in direct proportion to the length and incomprehensibility of their names. The public are now beginning to read about the germ-theory of disease; and hearing that fevers may be produced by germs, and being told that germs are found in water, they very naturally but illogically infer that any small bodies found in the water are the germs of disease. Whatever of truth there may be in the germ-theory of disease, there is no doubt that designing persons impose on the credulity and fears of the public by representing as germs of disease microscopic plants which could not possibly have caused any of the diseases which have been supposed by scientific men to be produced by germs of a vegetable nature."

After speaking of the higher water-plants, such as *Myriophyllum*, *Anacharis* and *Potamogeton*, the writer proceeds to consider the algæ.

"Whatever their shape may be, we may, in considering the effect which they produce, divide the algæ into two groups: those which are grass-green or yellowish-green, and those which are bluish-green or purplish."

"Considered from a sanitary point of view, we may say that the grass-green algæ have no injurious effect upon the water in which they grow On the contrary, we may regard their presence as an indication of its purity, for they do not grow in impure water. If almost any river or pond water, no matter how clear it appears, is placed in a covered glass jar, in a few days or weeks there will be formed a greenish expansion on the sides and at the bottom, which, on examination will be found to consist principally of the young stages of development of some of the algæ which we have already described."

"We may next pass to a consideration of those algæ which have a bluish-green color. The color is of importance, because by its means, any person of ordinary intelligence can distinguish the present group of algæ from those already described; and while, as we saw, the latter are quite harmless, it is to the presence and decay of the former that we are able to ascribe the cause of some of the most decidedly disagreeable odors and tastes found in drinking water."

The characteristic odor given off in decay is aptly described as a pig-pen odor.

"Looking to the future, one may assert that no absolute remedy can be proposed in case of the ponds already affected. They should be cleared of weeds and substances in which the *Nostocs* may lodge; and, where it is possible to regulate the height of the water, it should not be allowed to fall rapidly in the hot weather. Large and deep bodies of water are less likely to be affected than small and shallow bodies, and gravelly bottoms are better than muddy. The escape of steam or hot water should never be turned into ditches or streams connecting directly with water supplies When such is the case, there is a most luxuriant growth of species of the *Nostoc* family, and the water becomes very foul."

"In one respect, the fears of the public may be set at rest. The theory that certain diseases, as fevers, are produced by germs of some low forms of plant-life, whether true or not, has no bearing on the present case. On the one hand, although we know that the species described in the present article do cause the disagreeable pig-pen odor, and do render the water at times unfit to drink. we know, on the other hand, that they do not cause the specific diseases whose origin is considered to be explained by the germ theory. The germs, so called, are all species of bacteria, distinct from the *Nostoc* family and much smaller."

"From a botanical point of view, the floating *Nostocs* are very interesting; but it is usually difficult to get good material for study unless one is on the spot. The species of *Anabæna* are especially prone to break up and decompose when sent by express, and the various preservative fluids are of little use. To determine the species one should have the spores and heterocysts in position. The best way of preparing specimens is, by means of a pipette, to drop some of the water containing the plants upon a piece of mica or glass, and let it dry. The specimens can then be sent any distance; and, on re-moistening, the plants swell up so that they can be well studied. If they do not at once recover their form, a little ammonia or potash may be added. Information about the winter condition of the vegetation is very much wanted; and especially do we need an accurate chemical knowledge of their relation to the water in which they grow."

Destruction of Obnoxious Insects by Means of Fungoid Growths. By Prof. A. N. Prentiss.—This pamphlet is devoted to the detailing of experiments to test the proposition that certain obnoxious insects can be destroyed by the application of the Yeast Fungus. The result seems to be that yeast cannot be depended upon to rid our house plants of the insects that commonly infest them. Of course Prof. Prentiss does not claim that his experiments decide the whole general question, for yeast may be efficient in the destruction of other obnoxious insects, or some other fungus may be used as a remedy where yeast will not act.

Botanical Gazette.

Vol. V. DECEMBER, 1880. No. 12.

EDITORIAL.—THE OXFORD BOTANICAL GARDEN is pleasantly described by a correspondent of the *American Agriculturist* who is traveling in England. It is said to be the oldest Botanical Garden in England, if not the oldest in existence. It was completed in 1663. "It was pleasant to meet with many of our familiar American plants, conspicuous among which was our Poke or Pigeon-berry. Another home plant was our Cardinal Flower (*Lobelia cardinalis*), the flowers of which were much larger than at home, but not of such an intense scarlet."

THE TORREY BULLETIN has begun the publication of a list of the state and local floras of the United States. The October number contains such a list for the New England States, and as far as we know it is quite exhaustive. Assistance is asked in making the list as accurate as possible.

DR. T. F. ALLEN calls attention to the fact that the same similarity between the floras of Eastern Asia and America is noticeable among the *Characeæ* as has been observed by Dr. Gray with respect to higher plants.

THE SYRACUSE BOTANICAL CLUB still continues to be one of the most active clubs in the country. During the past season they have taken 29 club excursions, and combining profit with pleasure, have realized over twenty dollars from them An Authors' Party brought them in ninety more, and thus they are able to order an herbarium case, rent a room, and buy some microscopes and books. They are working towards publishing a complete catalogue of the flora of Onondaga county and most certainly deserve all the success that has come to them in such liberal measure.

HABENARIA GARBERI should have been described in the last number of the GAZETTE with "lips longer than the perigone," instead of "lips larger."

MR. A. H. CURTISS has undertaken to collect Baron Eggers' set of West Indian plants and hence will probably issue but one more set of U. S. plants. Those who have felt uncertain about Baron Eggers' specimens will now feel perfectly safe in ordering sets, as Mr. Curtiss' fine specimens are to be seen in almost every herbarium in the country.

A SUMMER ON ROAN MOUNTAIN.—This mountain ever since Dr. Gray's first visit in 1841, has been a *locus classicus* to botanists, though but few have visited it.

Three years ago a party of fifteen from the Nashville meeting of the American Association made the ascent, by invitation of Gen. Wilder, the owner of the mountain, and the writer collected largely at that time. During the past summer an almost continuous scientific convention has been informally assembled on the summit; Profs. Goodale and Gibbs, of Harvard; Prof. T. C. Porter, of Easton; Dr. Leidy and Messrs. Thos. Meehan and Joseph Wilcox, of Philadelphia; Capt. J. Donnell Smith, of Baltimore; Profs. Phillips and Symonds, of Chapel Hill, and Mrs. Geo. Andrews, of Knoxville, being of the number, so that not only the plants but the minerals, the rhizopods, the mollusks and the meteorology were all looked after.

It was the writer's good fortune to remain there from June 25th through July and August, and this article will give some notes of the results of his labors.

The mountain is reached from Johnson City on the East Tenn., Va., & Ga. R. R., and from Marion on the W. N. C. R. R. The former route is by stage 32 miles, and takes from early morn till nearly dark, over a preposterously rough road. The first ten miles lie along Buffalo Creek, through a limestone country, presenting the common plants of the region, the only thing of special botanical interest being *Asplenium parvulum*, on a limestone ledge. Crossing a slight ridge, we strike the waters of Indian Creek, running through a quartzite country, and in less than half a mile the flora undergoes a complete transformation. In a few minutes we are riding through the thickets of *Alies Canadensis* (Hemlock), *Rhododendron maximum*, and *Leucothoe Catesbæi*, called "laurel," and said to be fatal to horses.

Calycanthus floridus is noted, also *Asarum Virginicum*, under the bushes with its glossy evergreen leaves, and *Oxydendron arboreum*, conspicuous with its long white racemes. Ten miles further on we cross Iron Mountain, at an elevation of 1500 feet above the valleys on either side, and see large patches of *Galax aphylla*, with its white spikes, and along the roadside, *Leucothoe recurva*, *Clethra acuminata*, and *Magnolia Fraseri*. From the summit we catch our first glimpse of Roan, and then dashing down the valley of "Big Rocky," four miles bring us to its base, 2900 feet above the sea, and we look up to the summit 3500 feet above us, and seven miles distant by the road.

Between 3000 or 4000 feet of altitude we notice the enormous chestnuts, *Castanea vesca*, one measuring 24 feet in circumference, and hundreds of others five and seven feet around and running seventy or eighty feet without a limb. A little higher *Acer saccharinum*, *Magnolia acuminata*, *Liriodendron Tulipifera*, *Betula excelsa*, *Tilia Americana*, *Æsculus flava* attain enormous dimensions. One specimen of *Prunus serotina* (black cherry) was measured, which was 19 feet in circumference and probably 70 feet without a limb, and straight as a pine.

About sunset we reach the summit, which, unlike the Northern Appalachians, is a smooth grassy slope, containing, perhaps, 1000

acres, with rocky bluffs at the northern and southern ends, a mile and a half apart, named respectively Roan High Knob and Roan High Bluff, rising about 100 feet above the slope, the former reaching an altitude of 3690 feet. The soil is deep, rich and black, the green turf dotted with clumps of *Alnus viridis* and *Rhododendron Catawbiense*. This latter presents one of the most beautiful sights that can be imagined, with its domes of rosy inflorescence 6 and 8 feet in height, and so abundant that the whole mountain top is colored by it. The distinction between this and *R. maximum*, founded on the shape of the leaves and the tomentoseness of young leaves and branches, is hard to be maintained, in many cases. But the color is unlike any of the numerous shades of *R. maximum* and the capsules are smooth, while those of the other are viscid hairy.

The hotel is built of logs, but is comfortable enough for a botanist, and comfortably kept by Mr. L. B. Searle, who engineered the road up the mountain.

The average daily temperature is from 55 to 65 degrees; twice the mercury reached 75 degrees for an hour or two, and once it was 45 degrees. The spring which supplies the house has a temperature of 45 degrees. Roaring fires are in demand morning and evening.

The first thing to be done, was to secure specimens of those early species which were going out of flower. After that, the daily task was to watch the successive blooming of different species, and to explore new localities.

In moist places we find abundantly *Diphylleia cymosa*, *Cardamine Clematitis*, *Saxifraga crosa* and *leucanthemifolia*, *Ligusticum actæifolium* and *Chelone Lyoni*.

In the woods occur plentifully *Thalictrum clavatum*, *Astilbe decandra*, *Arisæma polymorphum*, the common species on the mountain, with leaflets less acuminate than *A. triphyllum*, and the lateral ones rhomboidal, when not lobed, sometimes one, sometimes two-leaved. *Ilex monticola*, *Vaccinium erythrocarpon*, "a blueberry bush with a cranberry flower," *Menziesia ferruginea*, var *globularis*, a straggling rusty shrub, with the blossom of a checkerberry, and *Galium latifolium*.

Lower down are found plentifully *Blephilia hirsuta*, *Pycnanthemum montanum*, *Rudbeckia laciniata*, *Cacalia reniformis*, *Monarda fistulosa* and *didyma*, *Lophanthus scrophulariæfolius*, *Scutellaria versicolor*, *Veratrum parviflorum*, and many other species more or less common elsewhere.

In the open plains we collect *Trautvetteria palmata*, *Arenaria glabra*, *Houstonia serpyllifolia* (everywhere forming extensive patches, so as to interfere with the grass) *Houstonia purpurea*, var. *montana*, and *Danthonia compressa*. Among the rocks and on the edges of the precipices are found *Paronychia argyrocoma*, *Geum radiatum* and *geniculatum*, *Heuchera villosa*, *Sedum Rhodiola* and *telephioides*, *Œnothera glauca*, *Angelica Curtisii*, *Cynthia Dandelion*, var. *montana*, *Vaccinium Constablæi*, *Leiophyllum buxifolium*, var. *prostratum*, *Campanula divaricata*, *Cuscuta rostrata*, *Agrostis rupestris*, *Carex æstivalis*, *debilis*, and

juncea, and *Lycopodium Selago*, and under overhanging cliffs, the delicate little *Saxifraga Careyana*.

The most conspicuous and beautiful of all, except, perhaps, the Rhododendron, is *Azalea calendulacea*, with the flame colored blossoms varying from golden yellow to crimson, and seeming as if the mountain side were on fire.

Several excursions to Little Roan, four miles away, and of nearly equal height, gave us in addition and in great profusion, *Delphinium exaltatum*, *Silene Virginica*. *Liatris spicata*. *Rudbeckia triloba*, *Cirsium muticum*, *Castilleia coccinea*, *Physostegia Virginiana*, and *Melanthium Virginicum*, with conspicuous white flowers. A tramp of eight miles to Roaring Rock was rewarded with several fine specimens of *Aconitum reclinatum*, with blossoms rather more blue than white.

Cimicifuga racemosa and *Americana* are abundant everywhere, the latter a month later, succeeding the former and easily distinguished, even at a distance, by the radiate arrangement of its stamens.

The most abundant plant is *Eupatorium ageratoides*, covering the whole mountain for 2000 or 3000 feet of perpendicular height, until replaced below by *Verbesina Siegesbeckii*.

The Compositæ are well represented in local forms. *Solidago spithamæa* and *glomerata* are abundant on precipices, *monticola* and *pubens* in open woods, and *Curtisii*, entirely replacing *cæsia* on the sides of the mountain. *Nabalus Roanensis*, n. sp. occurs in the clefts of the rocks

Aster Curtisii is found on the sides of Iron Mountain, and was noticed abundantly along the railroad.

Perhaps the most interesting plant is the rare and beautiful *Lilium Grayi*. The specimens found were well marked, 1 to 5 flowered, horizontal, not nodding; segments not at all recurved nor even spreading; the flowers smaller, more truncate in outline, and much darker than *L. Canadense*. The persistent and careful search of all the botanists, with efficient help from many others, brought to light only 10 specimens, all growing in clumps of Alder or Rhododendron, and thus protected against cattle, sheep and hogs, those enemies of all botanists, who bid fair at no distant time to exterminate it from Roan. It is to be hoped that the Peaks of Otter, its other known locality, may not be thus ravaged.

Abies Fraseri is plentiful near the summit, and very conspicuous with its abundant erect fringed cones.

The turf is of a most vivid green even in August, and seems to be made up of *Poa annua*, *Danthonia compressa*, and perhaps some early flowering *Carices* *Poa compressa* occurs on Little Roan.

Several mollusks have been detected on the mountain, by Mrs. Andrews, either very rare, or unknown elsewhere.

A trip to Bakersville, ten miles away, was rewarded by *Helianthus microcephalus* and *atrorubens*, and *Euphorbia Lathyris*, the latter thoroughly naturalized along the roadsides and very conspicuous.

Of most of the species enumerated above I have an abundant

supply, which I will exchange for U. S. species not in my herbarium, or will sell at ten cents a specimen.—J. W. CHICKERING.

CARNIVOROUS PLANTS.—The advance of science and of human insight into the workings of Nature compel us to admit what seems at first almost incredible, that it is as natural and normal for some plants to derive their sustenance from the animal tissues by a true process of feeding, as it is for the animal to feed upon plants and gain maturity and strength thereby.

The fact that certain plants, such as *Drosera*, *Dionæa*, *Sarracenia*, *Utricularia* and others, obtain at least a portion of their nourishment from animal food by process of digestion, absorption and assimilation, has been developed more during the last generation than at any previous time, although the peculiarities of one of these plants were known and noted during the latter part of the eighteenth century. Dr. Darwin tells us that the oldest and most valuable paper published previous to 1860 was written by Dr. Roth in 1782. Much has been recorded, in a general way, in our various journals, concerning these plants, but only a small proportion of these papers are of much value.

However, interesting as the discussion of the bibliography of this subject in its various relations and a review of the arguments both for and against the carnivorous characters of these plants, would be, it is not my intention to enter into a consideration of the general subject, even if space would permit, but to simply record my experiments and observations upon the interesting division of these plants—the genus *Sarracenia* and the family *Droseraceæ*. For an extended review the reader is referred to Darwin's work on the "Insectivorous Plants," and also to articles in Gray's Darwiniana.

It is the intention to publish these records in series, divided according to the time and purpose of experimenting and observations.

At the head of each series notes explanatory in general of all the experiments enumerated will be given.

SERIES I. Experiments on *Drosera rotundifolia*.

General observations. The plants upon which experiments were instituted in this set were under cultivation. The surrounding conditions were, as near as it was possible to make them, the same as those in which they grow naturally.

The amount of light, moisture and air was regulated with great care. The plants were watered at 8 a. m. and 6 p. m., daily, throughout the entire time of experimenting. It is worthy of note that the plants blossomed also during this time

As to the size of the leaves and the general vigor of the plants, they were the *finest* specimens that I could find. They were obtained at a lake, three miles west of Ann Arbor, Mich.

EXPERIMENT No. 1.—A piece of an angle worm was placed upon the center of a leaf at 2 p. m., June 4th, 1879.

15 min. no change.

30 " submarginal tentacles inflecting and a few nearest the substance were touching it.

45 min. the submarginal tentacles on one side of the leaf were much inflected, so as to touch the specimen.
60 " the same as the last, except the upper submarginal tentacles begin to inflect.
90 " marginal t. beginning to inflect.
2 hrs. only a slight change.
2½ " the submarginal t. nearly all inflected, and these nearest the substance touching it.
3½ " slight change among the marginal t.
18 " the submarginal and marginal tentacles inflected so as to touch the specimen on one side; the remainder inflecting slowly.
24 " change only slight.
38 " all the submarginal inflected and touching the substance, and, also, nearly all the marginal tentacles.
48 " all the tentacles inflected, touching the substance; the edges of the tentacles are also slightly inflected
66 " tentacles and edges of the leaf closely clasping the specimen.
123 " the same as the last, except the edges of the leaf are beginning to reflex.
159 " edges of the leaf reflexing slowly, but all of the t., except a few marginal ones, are still inflected.
166 " leaf gradually opening.
216 " leaf nearly expanded, but most of the t. still inflected somewhat.
302 " tentacles reflexing rapidly.
312 " tentacles, both disk, marginal and submarginal, on one side much reflexed.
326 " tentacles apparently dried not much reflexed from the last.
408 " no change, excepting that the ones already partly reflexed are more so.
528 " tentacles considerably dried; leaf without color; substance dried; no secretion.
600 " leaf and tentacles still somewhat inflected, but all parts apparently gradually opening.
648 " same as the last; a white mould present on the leaf; tentacles, especially the ends of some, dry; no secretion.
672 " no mould present; one side of the leaf dry and dead.
768 " leaf completely dried and dead. - W. K. HIGLEY, *Ann Arbor, Mich.*

BROWN UNIVERSITY HERBARIUM.—In addition to the classical herbarium of the late Stephen T. Olney, bequeathed to Brown University, together with a fund for its increase and for the maintenance of the botanical library, the college has, within a few weeks, received from Mr. James L. Bennett, of Providence, a gift of his herbarium of 13,000 species. This valuable collection has been amassed during thirty years of unremitting labor as a side occupation. In it are rep-

resented nearly all the regions of the globe—even some of the most remote and inaccessible. The specimens are in fine condition, but mostly unmounted. The University accepts them on Mr. Bennett's terms, which are simply that they be mounted, cased and properly cared for; also, that they be made available to botanical students under proper restrictions. Mr. W. W Bailey, since 1877 Instructor of Botany at Brown, has now the additional title and duties of Curator of the Herbaria. The united collections of Messrs. Olney, Bennett and Bailey, make a nucleus of which any institution might be proud. It is well known that Mr. Olney was a specialist of high rank in the study of *Carex* and his collection of Carices must remain classic. The herbarium is, however, rich in American botany generally, and contains some fine special *suites*, as Robbin's *Potamogetons*, Sullivant's and Austin's Mosses. Wright's Cuban Plants, Hall and Thurber's and Fendler's collections, &c. Accompanying *Carex*, are the exquisite colored drawings by J. H. Emerton, made under Mr. Olney's direction, to illustrate his projected monograph of the genus. Valuable notes accompany these. Mr. Olney's botanical correspondence covers many years and is of peculiar interest. It contains letters from all the leading botanists of America.

The curator takes pleasure in calling attention to the Brown University Herbarium, and asks aid of his scientific friends in increasing and extending its usefulness. Every courtesy will be extended to visiting botanists.—J. M. C.

Death of an old Botanist.—Dr. S. B. Mead died at his home in Augusta, Illinois, Nov. 11th, 1880, in the 82d year of his age. He was born in Connecticut, graduated from Yale College in 1820, and in 1834 settled in Augusta. In the practice of his profession, taking long rides over the prairies in every direction, he had an opportunity to study the flora of the region before it was disturbed by cultivation. He collected largely and made some interesting discoveries, his best find being *Asclepias Meadii*, which is a rare plant in collections even now. He exchanged with the leading botanists of the past generation and did not lose his interest in botany up to the day of his death. The writer visited him last spring, found him active and in good spirits and took pleasure in looking through his collection with him. His death was caused by a fall several weeks previous, but he was able to be about until the last and died with very little suffering. His collection includes many interesting Western and Southern plants gathered by Hall, Lindheimer, Ravenel, T J. Hale, M. A. Curtis, Dr. Short and others. It would make a valuable present to some college, or would enrich the herbarium of almost any private collector. It will be disposed of together with his botanical library, by his widow, Mrs. S. B. Mead, Augusta, Ill.—*

Contributors to Mr. S. T. Olney's *Carices Boreali Americana* are requested to communicate at once with Mr. James L. Bennett, of Providence, R. I., who has been requested by President Robinson,

of Brown University, to which Mr. Olney gave his botanical collection by will, to complete the distribution so far as the plants received and determined by the testator will allow. Mr. Bennett, in assisting me with his great experience, has had sole charge of *Carex* and brought neatness and order out of much that was chaotic. He will be prompt to respond to any and all inquiries.—W. W. Bailey, *Curator, Brown University Herbarium.*

Recent Publications.—*Check List of North American Gamopetalæ after Compositæ.*—This is a very neatly printed pamphlet of 12 pages, published by Harry N. Patterson, Oquawka, Ill. Mr. Patterson's printing is well enough known to be its own recommendation and the list given will be of very great use. We very much need a new and complete check-list of all our North American Phænogams and Vascular Cryptogams, with every species numbered as in Mann's Catalogue. It is vastly more convenient to write out a list of numbers than of long botanical names. For price see the advertisement.

Practical Uses of the Microscope.—This is included in the Inaugural Address of Dr. R. H. Ward to the American Society of Microscopists. No one could be much better fitted for speaking upon such a subject than Dr. Ward. The practical use most largely spoken of is what may be called the legal use, such as the examination of signatures, etc. With considerable curiosity we looked through the pamphlet to see the opinion of such high authority concerning the practical importance of the binocular arrangement. This is what we found: "The binocular arrangement has grown from an experiment of disputed value to a priceless luxury if not a literal necessity." We would like very much to know from our working histologists how much they use the binocular arrangement, and if they use it at all, with what powers.

On the Microscopic Crystals Contained in Plants.—Mr. W. K. Higley, of Ann Arbor, has been examining a great many plants with reference to their crystals and the results are brought together in this paper, a reprint from the *American Naturalist.* The crystals are considered under the three heads of Raphides, Sphæraphides and Crystal prisms. These names have already been defined in a previous notice, but it may be said further that Mr. Higley's observations seem to show that the raphides are composed of phosphate of lime, the acicular or crystal prisms of oxalate of lime, the cubical crystals of carbonate of lime, the sphæraphides of the same base combined with different acids according to locality. The author thinks that their great abundance would point to some use to the plant itself. Two uses to man are suggested, first, that the phosphates these crystals contain may strengthen bones, and second, through decaying leaves and stems they act as a fertilizer. A list of 71 phænogamous families is given, known to contain crystals, 46 being exogens and 25 endogens.

Useful and Noxious Plants.—This is the first annual report upon this subject by Prof. T. J. Burrill, Botanist of the Illinois State Board

of Agriculture. It makes a pamphlet of 9 pages, two being devoted to "Trees," one to "Noxious Plants" and six to "Fungi on Living Plants," which, of course, shows the direction of the writer's principal observations. The Catalpas are noticed, and also White and Green Ash and Spanish Oak. Under the head of Noxious Plants are included what we loosely call "weeds." Some of the most pestiferous are mentioned and especial attention called to the fact of their wonderful fecundity. The part on Parasitic Fungi is by far the most important as it gives some account of a group of organisms very important to farmers and very little understood.

On the Development of Lemna minor.—This is a four-page pamphlet with plate, reprinted from the Proc. Acad. Nat. Sci. of Phila. The author, Mr. Wm Barbeck, had his attention called to the so called "bulblets" and after careful investigation has come to the conclusion that they are in reality regular *seeds*, from which, however, the fronds are propagated in a peculiar and interesting manner. The figures given are taken from sections which he has mounted and hence may be compared at any time. The closing sentence gives the author's conclusions. "My investigation has been made only on the *Lemna minor*, but there is no reason to doubt that in the development of the whole family of *Lemnaceæ* (analogous to our species) we have an interesting instance of parthenogenesis, there being seeds (produced in autumn by a sexual process) from which, during the course of the summer, generation after generation is propagated without any further fertilization."

On the Timber Line of High Mountains.—Mr. Thos. Meehan in a paper before the Acad. Sci. of Phil. upon this subject, came to the following conclusion:

In view of the facts detailed we may conclude that at the elevation of these mountain chains, the lowland vegetation was carried up at the same time. The summits, covered by luxuriant forests would present a cooler surface to the moist clouds, and there would be less condensation than on bare sun warmed rocks, and deep snows would be less frequent, and not sufficient to interfere much with arboreal growth. But the rain would of necessity carry down the earth and disintegrated rock to lower levels; and the melting snows, such as there were, would make this downward progress of the soil continuous. In some mountains where the rock was easily broken by frost, as in Colorado and the White Mountains, it would be very difficult for the soil to hold its own against these forces of gravitation; but on more solid rock the mass of tree roots protecting the rock, and retaining the earthy matter would longer hold its own. In the former case with the gradual washing away of the earth the larger trees will have to find a lower level; the summit condensing more moisture, and having a cooler atmosphere, would form heavier masses of longer enduring snow, and thus keep down from tall growth the younger trees left as the older and larger ones retired. They would have to be low bushes by the absence of earth for vigorous growth, and remain

trailing bushes, through the superincumbent and long continued mass of snow.

We thus see that though a long continued mass of snow has much to do in marking a timber line, that line is precedent to the snowy mass. The primary cause is the gravitation of disintegrated rock—the movement of the hill top towards the sea. From the moment the mountain reaches its highest point it commences its downward march. The entire reduction of the highest to a level with the plain is but a question of time. The frost and rain and melting snow will do it all, and this reduction, bringing down not only the earth, but cold loving plants to warmer levels, must continually change the aspects of vegetation, as well as perpetually vary the timber line.

In low hills as well as in high mountains the forces of gravitation are also at work. But the sides are seldom so steep as in the loftier hills—the rains do not gather with such force nor are the melting snows of near the same duration. There are sudden washes, but not the continuous roll of the earth to the bottom. In time they may exhibit the same phenomena of the disappearance of species from their summits as their loftier brethren; but the centuries here will gather much more slowly to produce a similar effect.

In conclusion we would say briefly that the "timber line" of high mountain tops results from the washing down of the earth from the higher elevations.

NOTES FROM UTAH.—*Corydalis Cascana*, Gray.—I have added two stations more to that of last year for this plant. One station is in American Fork Canon, 7,500 feet altitude; the other, above Silver Lake, at 11,000 feet altitude. It is difficult to secure good seed, because an insect infests the pods and destroys the seeds; but I have secured a small quantity. The bursting of the pods is interesting. They split at the end, and the segments coil up with such rapidity that the seeds are thrown three feet or more. I believe this plant has never been discovered north of Arizona before, and is rare there.

A remarkable monstrosity of *Ranunculus Cymbalaria* occurs here. The flowers (ten or twenty) are united in a half circle, making one large flower with ovaries arranged in a half moon and surrounded by from one to two hundred petals.

Dicentra uniflora, Kellog. This is not uncommon in City Creek Canon; but, unlike Coulter, I found leaves only with the exception of a single faded flower.

Streptanthus cordatus.—The petals are twice the sepals, and stems are often branched.

Vesicaria montana.—This occurs as far south as St. George.

I have a variety of *Arabis arvnata* with pods much wider at tip than at base. The siliques of *Lepidium Wrightii* are frequently hairy on the edge. The leaves of *Arabis Lyallii* are as often auricled as sagittate. *Capsella divaricata* has the appearance of an introduced plant at St. George, where it is very common.

The roots of *Stellaria Jamesiana* are thickened into a long series of tubers.

Vicia exigua occurs as far north as Holden (100 miles south of Salt Lake City.) It has not been reported further north than St. George before.

The stems of *Astragalus junceus* are very seldom "solitary." They usually grow in clumps of twenty to a hundred.

A. pictus var. *filifolius* is found at Frisco and Milford, the western border of Utah, one hundred miles north of St. George.

Cercocarpus ledifolius, var. *intricatus*.—I propose this name for Watson's *C. intricatus*, which cannot rank as a species, as Dr. Parry has shown already; but I think it deserves to rank as a variety and not as a "form" (Parry), because of the altitude at which it occurs, 6000 feet, and the apparent distinctness of the extreme forms. This is from 1 to 3 feet high, densely and intricately branched, usually depressed; leaves linear, 6 to 12 lines long, 1 line wide, very revolute, sparsely pubescent, flowers and fruit two and three times smaller than the typical form. Its present known range is from American Fork Canon to Cedar City. It appears to grow on rocks almost exclusively. Watson found it near the mouth of American Fork Canon, where it occurs in the extremme form only. Higher up it occurs more sparingly, and in less rocky places shows an insensible transition to *C. ledifolius*. I have found it as high as 11000 feet altitude, growing along with *Juniperus communis*, var. *humilis*, Eng. (*J. communis*. var. *alpinus* of most authors), several hundred feet above *Primula Parryi*. near *Synthyris pinnatifida*, *Ranunculus adoneus*, etc.; but its usual range is at about 6000 feet altitude.

Who described *Tellima tenella?* Watson gives it as of Hooker and Bentham (King's Exp. p. 95), Watson and Brewer give it as of Watson (Fl. Cal. V. I. p. 198), and Rothrock gives it as of Walp. (Wheeler Rep. p. 117). The Rocky Mountain *Cratægus*.—I have spent much time in studying this plant, and have collected a full suite of specimens, from the buds to the fruit. The leaves on branches which bear flowers are lanceolate or ovate lanceolate and acuminate, narrowly cuneate at base; other leaves vary from acuminate to barely acute, lanceolate to broadly oval, cuneate or tapering at base; petals orbicular, entire; calyx segments linear or linear-lanceolate usually with a broad base, purple, glandular ciliate; bracts filiform, purple, deciduous; thorns almost none, or abundant. *Ribes aureum* is abundant at St. George. There is a variety of it growing here that has *yellow* fruit and a disagreeable taste. I have *Ribes leptanthum*, var *brachyanthum* from Frisco, as well as Lake Point. *Mentzelia lævicaulis* occurs as far south as Frisco.

The fruit of *Cymopterus glaucus* is densely pubescent; stamens purple.

C. longipes is abundant at Juab, and occurs at Frisco.

I have another species of *Cymopterus* that appears to be new also.

The petals of *Orogenia linearifolia* are white. It blooms close to

snow in the early spring; is very evanescent. Within a few weeks after the plant appears, it has bloomed, fruited, dried up, and blown away, leaving no trace behind save a few seeds in the sand. I have the flowers from Scipio (30 miles north of Fillmore) and plenty of good fruit from City Creek Canon where it is common. The leaves are frequently 6 lines wide. *Peucedanum simplex* is occasionally branched as well as leafy. The fruit is never "orbicular" in any Utah specimens I have seen. It is abundant here.

P. millefolium has yellow flowers, not "white." It occurs in the Wasatch and south to Frisco.

The fruit of *P. villosum* I have in fine condition. The oil-tubes are either wanting, or one in the intervals and two outside of the ribs. On the commissure are numerous grooves but the oil-tubes appear to be wanting or imperfect. I have P. *Newberryi* from Frisco. The fruit varies greatly.

The fruit of *P. Nevadense* is glabrous; varies from oval to narrowly oblong, always emarginate at base in my specimens.—MARCUS E. JONES, *Salt Lake City*.

NABALUS ROANENSIS, n. sp.—Stem simple (3 to 12 inches high), hirsute sparingly, and on the veins on the under side of the leaves and the peduncles abundantly, with long, transparent hairs; heads in short axillary racemes forming a close racemed panicle; leaves 1½ to 2 inches long, triangular halberd shaped, acuminate, coarsely toothed, on slender petioles, the lower 2 or 3 inches long, and winged above; involucre 10 to 13 flowered, of 7 to 10 light green linear scales, with dark obtuse tips, hairy in a line along the middle, and 3 or 4 dark green, triangular ovate, bract-like, densely hairy ones, at base; pappus straw color.

The leaves resemble those of *N. alatus*, the flowers are somewhat like those of *N. nanus*.

Found sparingly on the summit of Roan mountain, N. C., growing in the clefts of precipices.—J. W. CHICKERING.

THE GAZETTE FOR 1881.—This number closes Vol. V, and very soon No. 1 of Vol. VI will appear. We take this opportunity of urging our friends to renew their subscriptions at once and to aid us in obtaining as many new ones as possible. The long lists of botanists in our Directories shrink to a very small per cent. upon the pages of our subscription book. For the credit of American Botany we ought to be able to generously support two modest journals.

COLUMBIA COL.
HERBARIUM
NEW YORK

Botanical Gazette.

Vol. VI. JANUARY, 1881. No. 1.

EDITORIAL.—It is very pleasant to receive the congratulatory letters of subscribers that are coming in faster than ever before. We have tried to make the GAZETTE attractive and useful to botanists, and of course it is gratifying to know that the effort has been successful. Such words only stimulate us to greater efforts, and it is our desire to make Vol. VI better than any before it.

THE FLORA OF INDIANA.—It is the intention of the editors of the GAZETTE to publish a catalogue of the Flora of Indiana. In this work they will be aided by Prof. Chas. Barnes of LaFayette. The catalogue will appear in the form of "extras" to the GAZETTE, and it will be completed within the year. A preface and title page will be published near the end of the year, thus enabling the patrons of the GAZETTE to bind their extras together in a neat pamphlet. It is earnestly desired that any botanist having knowledge of the plants of Indiana shall put himself in communication with the authors of this catalogue. Especially do we urge every botanist in the State to send us lists and specimens. All specimens will be carefully used and returned if desired, but in every case they must accompany lists before they can be considered authentic and included in the catalogue. Full credit will be given for all such help

A BOTANIST'S MARRIAGE.—It is not often that the GAZETTE feels called upon to notice a marriage, but this one is so botanical that its mention seems very appropriate. Prof. J. G. Lemmon, the well-known California botanist, was recently married to Sara A. Plummer, of Santa Barbara, another well known botanist. The notice states that they will reside this winter in Oakland, and having united fortunes and herbaria, are ready to welcome their friends in their new herbarium rooms.

MR. HENRY M. DOUGLAS, of S. Richland, N. Y., is issuing a translation of A. de Bary's *Botanische Zeitung*. He asks one dollar for 10 numbers. The second issue will be from 1880.

MR. A. H. CURTISS intends to issue two more fascicles of United States plants before going to the West Indies; Fascicle IV the first of January, and Fascicle V next summer. This will correct a statement made in the last GAZETTE that Mr. Curtiss would probably issue but one more fascicle of U. S. Plants. He will spend the rest of the winter in South Florida, and will not distribute the second set of ferns till after his return.

NEW SPECIES OF PLANTS FROM NEW MEXICO.—DELPHINIUM SCAPOSUM.—Leaves all radical, rather fleshy, pubescent, 3-parted,

the divisions broadly cuneate, 3-5-cleft or toothed, the teeth ending in a callous point; scape smooth, racemose at summit; pedicels as long as the deep azure flowers; spur incurved; root a cluster of thickened, fleshy fibres.

Hill country between the Gila and San Francisco rivers, May 25, 1880. An interesting species, as combining the leafless stem of the scarlet flowered Californian *D. nudicaule*, with the deep blue flowers of *D. azureum*. I am informed by Dr. Gray that Prof. Newberry obtained what appears to be the same, south of Diamond River in Arizona.

Draba Mogollonica.—Hirsute pubescent with branching hairs; stem a foot high, sparingly branched, nearly leafless, except at base; leaves with a few large teeth, spatulate-oblong; racemes elongated in fruit; silicles oblong, as long as the pedicels (½ inch), twisted and tipped with a long (1½ line) style; flowers very large, yellow.

Northward slopes of the Mogollon Mountains, April 18, 1880. With the habit and pubescence of *D. cuneifolia*, but perennial, very large and showy; the mountain sides being yellow with it in its flowering season.

Lepidium intermedium, Gray, var. pubescens.—Clothed with a dense roughish pubescence throughout; stouter, less branching, with longer racemes and larger silicles than the typical form; petals smaller or wanting.

Mangos Springs, May 31, 1880, in marshy gronnd, flowering two months later than the type which grows on the adjoining dry hills. Intermediate forms occur on the upper Gila.

Ribes pinetorum.—Without prickles; subaxillary spines solitary (rarely 2-3) stout; glabrous except the peduncles and petioles which are minutely white-tomentose; leaves 5-cleft, lobes incised; peduncles very short, erect, mostly 1-flowered; calyx somewhat campanulate, pilose-tomentose, the lobes spatulate. reflexed, one third longer than the stamens and petals; style glabrous, undivided; stigmas two; berry large, armed with many stout prickles.

Bush 5 to 6 feet high, sparingly branched and few-flowered; the flowers large and reddish yellow Those of *R. leptanthum*, to which it is most related, are hardly half as large, and white (not "yellow," as said by Mr. Watson in Bot. King). The fruit is one of the largest and best flavored of our wild gooseberries.

In woods of *Pinus ponderosa*, in the higher elevations of the Pinos Altos and Mogollon Mountains, flowering in April; fruit ripe in September.

Lithospermum Cobrense.—Stems a foot or two high, and usually several from the same root. Radical leaves linear spatulate, two or three inches long, hirsute and more or less hispid with stinging hairs, the cauline much smaller, mostly linear and smoother; corolla pale yellow, with ample limb deeply 5-cleft, no crests in the throat, and glandular ring at base of the tube naked, or with a few short hairs; flowers apparently nearly sessile, but fruiting calyces distinctly pedicelled.

Doubtless all that has been called *L. canescens* from New Mexico and Arizona is of this species. According to Dr. Gray it is Wright's No. 1563, Coues and Palmer's 275, and Rothrock's 202 and 633. That it is distinct from *L. canescens*, is obvious at first sight of the living plant, by the conspicuous tuft of root leaves. The pale yellow, fragrant flowers are commonly as large as those of *L. hirtum*. I name the species in reference to that classical locality, Santa Rita del Cobre, where Mr. Wright collected it first, and where I first saw it in 1877.

LITHOSPERMUM VIRIDE.—Sparingly strigillose, and minutely appressed-pubescent; clustered stems simple, 1½ to 2½ feet high; leaves pinnately 3-5 ribbed; the cauline lanceolate or oblong-lanceolate, 1-3 inches long, passing into lanceolate bracts; pedicels 2-3 lines long; calyx parted to the base into linear lobes a half-inch long; the light-green corolla salver form, 10 lines long; its ample tube somewhat clavate, being manifestly contracted at the orifice, without crests, and the glandular ring nearly obsolete, limb of 5 small, rounded lobes reflexed against the tube; stamens inserted high in the throat; style exserted; nutlets contracted to a narrow base, the scar excavated and surrounded with a prominent margin.

Collected in the Mimbres Mountains, near Georgetown, in 1877, and on Swan Mountain, near Silver City, 1880; flowering from May to October. A singular member of the genus, having wholly the aspect of an *Onosmodium*, and nutlets suggestive of *Symphytum*.—EDWARD LEE GREENE.

NEW LOCALITIES FOR SOME FLORIDA PLANTS.—Two years ago, when botanizing on the Halifax river at Port Orange, I first saw that beautiful shrubby vine, *Chiococca racemosa*, Jacq., and fell in love with its racemes of snow-white berries and glossy dark-green leaves. This year a friend described to me a vine which she had transplanted unsuccessfully from Anastasia Island, across our harbor, to her garden, and I hoped it might prove to be the *Chiococca*. I looked for it there in June, but did not find it. However, in August, a more extended search proved to my great delight that it is well established upon the Island. It was too late then to secure specimens of the flowers, as the young fruit had all set. This plant seems to be according to situation indifferently a small shrub, or a high growing shrubby vine. As soon as I have another opportunity to visit this locality, I shall transplant roots to my garden, and see if I can have this thing of beauty always near by.

Cynoctonum? scoparium, Chapm., is described in the Southern Flora as growing from "West Florida to Key West." Six years ago I found it near the old light-house on Anastasia Island, and it still flourishes there, climbing six or eight feet high over bushes and covering them with its masses of round green stems and small leaves. I also observed this *Cynoctonum* at Daytona, at Port Orange and in rich hummock lands on the banks of the Indian river; so I presume it can safely be ascribed to the east as well as the west coast of the State.

Mentzelia Floridana, Nutt., is not confined to the west coast. It is firmly established on Anastasia Island, and I have seen a few plants in a neglected spot here in town. I know, to my great annoyance, that it grew plentifully on Merritt's Island in the Indian River, because I heedlessly rambled about one day while botanizing and allowed my dress to become so covered with the old club-shaped hollow seed-vessels, leaves and bits of the brittle stems, that it required the active work of two friends during an entire hour to pick off the pests! The plant seems to be thoroughly armed with bristly barbed hairs, which are well adapted to promote the distribution of the seed vessels.

I saw a patch of flourishing *Iresine vermicularis*, Moquin., upon one of the banks of the Halifax river, and a few months since was pleased to find it establishing itself upon the banks of the Maria Sanchez creek in our town.

During the last three or four years I have occasionally seen *Kallstroemia maxima*, Torr. & Gray, as a very scarce weed in one or two places in cultivated grounds.

Avicennia oblongifolia, Nutt. is quite common on the shores of our inlet, and a *Pancratium* is commonly cultivated in our gardens, which I am sure must be the *Pancratium Caribaeum*, L., described by Dr. Chapman in the GAZETTE of March, 1878. It flourishes in cultivation, increasing quite rapidly, and the blossoms are large, very handsome and very fragrant.

Duranta Plumieri, Jacq , is an elegant shrub in our gardens noteworthy for its beautiful golden, wax-like berries, which remain on the bush a long time. Of the genus *Utricularia* we have about here four described species, *U. inflata*, *U. purpurea*, *U. cornuta*, and *U. subulata*. In October, 1879, I found in muddy places in the pine-barrens several specimens of the smallest *Utricularia* that I have ever seen, and this year I have collected it again in several localities. Prof. A. Gray wrote me last year concerning it, "I have little doubt it is *U. simplex* of C. Wright, Cuba," and that he had no specimens like it. It grows in the same localities with *U. cornuta* and *U. subulata*. The scape is stouter than that of *subulata*, but the corolla is much smaller.

Last spring I saw in the garden of a friend, living about twenty miles south of us, a number of flourishing plants of *Abutilon pedunculare*, HBK. The seeds were brought from the Indian River country, where the plant grows wild. These plants were four or five feet high, and taking kindly to their new home, were rapidly propagating themselves.—MARY C. REYNOLDS, *St. Augustine, Fla.*

CROSS FERTILIZATION OF THE CHESTNUT TREE.—I would like to publish the following field notes, for their bearing on the vexed question of the Cross-Fertilization of the Chestnut Tree:

The first white settlers came to this county (Wabash) in 1803. They were undoubtedly disappointed in not finding the old and familiar chestnut of their eastern homes; and so on their first visit to

the east, did not fail to bring back with them at least a few chestnuts to plant. The cabins being few and far between, the seed in this way became tolerably evenly sprinkled over the whole county. Those of us who are germain to the soil have no fond recollections of the surroundings of an eastern home to cherish; consequently this importation stopped with the days of our sires. The result is that, scattered over the county at the sites of the earliest log-cabins, the chestnut tree has reared its head as a monument of the days when the white man and Indian contended for the right of possession.

I have been able to learn the history of 17 trees, and this is probably all to be found in the limits of the county. The following notes have been made either from personal observations or from persons who are thoroughly reliable and familiar with the history; and in some cases the very individuals were consulted who planted the seeds. I will commence at the west side of the county and pass eastward, taking the trees seriatim.

No. 1 was on the F. M. Rigg farm. It grew from seed from Virginia, and when it was cut down, several years since, it was over 18 inches in diameter, and bore an abundance of sterile burs, occasionally a few nuts being found, never more than three or four during a season. No tree of any size nearer than three miles while it was standing.

No. 2.—Mr. T. Rigg has a tree on his place which he has grown from seeds from No. 4. It bore three sterile crops of burs He then grafted on it two twigs taken from No. 3. The first year the grafts bloomed (they being about 18 inches long) and the tree bore about three pints of nuts. Most of them grew near the grafts, which were on opposite sides of the tree, but a few nuts were scattered in all parts of the tree top. Last spring the grafts did not bloom, and this fall the abundant crop of burs were all empty. Nearest tree is five miles away (No. 4).

No. 3 grew on the J. Beall lot, in Mt. Carmel. It was over 18 inches in diameter when it was blown down by the cyclone, June 4, 1876. It was grown from the same lot of seed as Nos. 4 and 7. For years it yielded abundant crops of burs, but not a chestnut was ever found under it, so far as I can learn. Nearest tree two miles (No. 7).

No. 4 is a group of seven thrifty trees growing on the Wm. Davis farm, from seeds from Ohio, planted forty one years since—the same lot as those that grew Nos. 3 and 7. They measure in circumference, two feet from the ground, 37, 37, 49, 55 and 71 inches, and are near one hundred feet high. (A pear tree near by, planted at the same time, is 80 inches in circumference.) All bear in abundance, and it is very seldom that a sterile bur is found. These trees are one mile from No. 5.

No. 5 is a thrifty tree on A. Woods' farm, and is from fruit from No. 4. It is near thirty years old and bears more or less chestnuts every year, but the crop of empty burs invariably exceeds that of the filled. Is one mile from No. 4, in a northwestern direction.

No. 6 grew on the J. Woods' farm, and was one-half mile north-

west of No. 5. It was blown down last winter. It grew from seeds from Kentucky, planted 54 years since. It was known to bear fruit only one year, and that was eight years since; then only a few nuts. It will be observed that Nos. 4, 5, and 6 are in a line and nearer together than any of the others, being only 1½ miles apart at the extremes.

No. 7 is a thrifty tree growing on M. Reel's farm. It is from the same lot of seeds as Nos. 3 and 4. Is forty-five in hes in circumference, and annually bears a large crop of empty burs. On occasional years a few nuts have been found, never more than four or five. It is two miles from No. 3, and the same distance from No. 4.

No. 8 is a group of three trees, all standing within a few rods of one another, on J. Hurshey's place. They are from seeds from Ohio, planted by him in 1848, and are near one foot in diameter. Have borne chestnuts in abundance for more than twenty years, without one year of failure. These trees are 1¼ miles from No. 9.

No. 9 is a group of two trees standing near together on the J. Sitherland farm, grown from seeds which he planted thirty-five years since. Both bear fruit freely. "The burs are always full." They are 1¼ miles from No. 8. One tree is much smaller than the other, and is always fuller of nuts. The seeds were obtained from Perry county, Ind., which is about 70 miles away in a direct line, and if it is native there, is the nearest station of which I have any knowledge. These trees are 1¼miles from No. 8. (The chestnut is native in both Perry and Spencer counties, Ind.)

No. 10 is a tree, from seed planted by J. Hoff, on his farm, 34 years since. It is four miles from No. 9, and annually bears a large crop of burs, but never has a chestnut been found under it.

The foregoing observations point to the following conclusions, though they cannot be considered as positive demonstrations:

(1) That in some cases the chestnut tree appears to be sparingly self-fertilizing, while in others it appears to be sterile for a long succession of years. See Nos 1, 3, 7 and 10

(2) That trees grown from the seed of one tree, freely fertilize one another. See Nos. 4, 8 and 9.

(3) That a sterile tree, growing grafts from another sterile tree, becomes fertile when the grafts bloom, and sterile when they fail to bloom. No. 2.—J. SCHNECK, *Mt. Carmel, Ill.*

QUEER PLACES FOR FERNS.—I think I may claim a *new locality* for a common fern. While recently exploring an extensive live-oak hummock, I came to a lofty pine-tree, *Pinus australis*, I think, which had had a large notch cut in it, about three feet from the ground. Upon the base of this notch, with its roootstock firmly fastened to the tree by the exuding pitch, grew a brave little upstart of a *Woodwardia Virginica*, Willd., its three or four six inch-long fronds healthy even though dwarfed, and two of them well fruited. Several of the pinnæ had been glued fast to the side of the tree by a thin film of the pitch. Two years ago I saw large, handsomely-fruited fronds of the *Polypo-*

dium aureum, L., which grew in the same hummock. Upon investigation, I was surprised to find that they grew upon a live-oak tree. Except in one instance, where a single plant of this fern grew inside a hollow burned stump of some swamp tree, I had never seen or known that *P. aureum* would grow on any tree but the Palmetto, except where in two or three cases, roots had been transplanted to congenial homes on the trunks of cultivated date-trees here in town. One of the trunks of this live oak had been cut down, and upon this cut place, where the wood was softer from consequent decay, the fern had obtained a resting-place and had gone vigorously to work. This fall I visited the tree again, and the fern was flourishing finely. Further search in the woods rewarded me by showing me a second fern growing on another live-oak tree under the same conditions, and I obtained good specimens from both trees. A fact which added much to the interest of finding the *aureums* in these unexpected places is that there are no large Cabbage Palmetto trees in the vicinity from which the fern could have been transferred, and the fern itself is also very scarce in this region.

P. incanum on the trees, and *Osmunda cinnamomea* on the ground, are the other representatives of the fern family in the same hummock. The *O. cinnamomea* is very common everywhere beside the "branches," and has been bearing an abundance of fruited fronds during the past two months.

Polypodium incanum is by no means particular as to its habits, growing on live-oaks, hickory and cedar trees. — MARY C. REYNOLDS, *St. Augustine, Fla.*

CARNIVOROUS PLANTS. II. — EXPERIMENT No. 2. — An ant was placed upon a leaf near the center of the disk, at 2 o'clock, June 4th, 1879. —

15 min. no change.
30 " the submarginal tentacles (reflexed at first) now nearly at right angles to the blade.
90 " only a slight change.
4 hrs. marginal tentacles moving slightly.
18 " the submarginal tentacles nearest the specimen much inflected, but as yet do not touch it. The marginal tentacles had moved only slightly from last note.
38 " submarginal and central tentacles inflected, but only the latter touching the specimen.
48 " about the same as the last.
66 " a slight reflexing is apparent.
73 " tentacles reflexing.
117 " tentacles nearly all reflexed except a few of the central ones.
144 " change only slight.
157 " some of the submarginal and a few central tentacles have again inflected, but for what reason, I cannot tell. *With a lens I could see no other animal or exciting substance of any kind upon the leaf.*

166 hrs. leaf nearly open; tentacles with no secretion and apparently dried.
216 " all the marginal and submarginal tentacles reflexed and those of the disk nearly so. No secretion.
233 " the leaf had assumed nearly its natural position and shape.
240 " all tentacles that were inflected are reflexing rapidly.
279 " all reflexed except the disk tentacles.
327 " completely expanded except disk tentacles on one side.
361 " some more reflex action.
409 " all expanded but one or two.
529 " completely reflexed; leaf with high color; no secretion.
601 " leaf natural; no secretion.
769 " leaf natural and with secretion.

EXPERIMENT No. 3.—A smaller piece of living angle worm than in No. 1, was placed near the center of the leaf at 2 p. m., June 4, 1879.—

15 min. no change.
30 " no perceptible change.
45 " submarginal tentacles slightly inflected.
90 " submarginal tentacles somewhat more inflected.
18 hrs. submarginal tentacles nearly all inflected and some touching the specimen; marginal tentacles moving.
24 " some change in the marginal tentacles from the last.
38 " some of the submarginal tentacles touch the specimen; marginal tentacles about the same as before.
73 " central tentacles still touching the specimen; marginal tentacles reflexing.
117 " submarginal and central tentacles still inflected and touching the specimen; marginal tentacles all reflexed; substance on the leaf dried
123 " many of the submarginal tentacles are reflexed.
144 " a few of the submarginal and all the central tentacles touching the specimen.
166 " about the same as the last, except that all the tentacles already reflexed are dried.
216 " the whole leaf has assumed its natural position, except the disk tentacles; no secretion.
233 " disk tentacles nearly reflexed.
303 " only a few disk tentacles at all inflected.
327 " completely expanded, except disk tentacles mentioned last.
361 " no further change except that the glands of the submarginal tentacles are covered with a white mold.
457 " same as the last; mold present also upon the marginal tentacles, which is gray in color.
490 " leaf with some color; no secretion; completely covered with a thin net work of mold.
529 " leaf apparently dead; color a dark-brown; mold disappearing.

601 hrs. leaf completely dried.*

EXPERIMENT No. 4.—A piece of wood was placed on the center of a leaf at 2 p. m., June 6th, 1879.—

60 min. no change.
75 " slight inflection of the submarginal tentacles.
18 hrs. most of the submarginal and central tentacles were inflecting slowly.
24 " there was hardly any change from the last.
38 " the submarginal tentacles had passed through an angle of about 45 degrees; no change in the marginal tentacles; no secretion.
73 " all the tentacles were reflexed and natural.
144 " for some reason the leaf seems to show some signs of dying.
175 " leaf with secretion on the tentacles.
185 " leaf perfectly natural.

EXPERIMENT No. 5.—Placed upon a leaf a minute larva of *Haltica chalytea* (about 1/8 inch long), at 8 a. m., June 6th, 1879.—

30 min. all of the central tentacles were bent so as to touch the specimen.
60 " the submarginal tentacles had passed through an angle of 45 degrees.
4 hrs. all of the submarginal tentacles were inflexed and many of them touched the specimen.
10 " nearly all the tentacles were inflexed, but only the submarginal and central ones touched the specimen.
22 " the tentacles showed signs of expanding.
29 " the edges of the leaf, submarginal, marginal and disk tentacles on one side inflected over the specimen.
67 " simply the submarginal and marginal tentacles nearest the specimen inflected and touching it.
73 " nearly all reflexed.
94 " all reflexed.
171 " leaf with secretion on the tentacles.
178 " perfectly natural.

A REFORMED SYSTEM OF TERMINOLOGY IN CRYPTOGAMS.—A paper was read lately before the British Association which suggests a very simple system of terminology for the reproductive organs in Cryptogams. The authors are A. W. Bennett and George Murray. An abstract of it is given in the Journal of Botany for November.

In the first place, a spore is defined as "*any cell produced by ordinary process of vegetation* (and not by a union of sexual elements) *which becomes detached for the purpose of direct vegetative reproduction.*" It may be the result of ordinary cell-division or of free cell-formation.

In the terminology of the male fecundating organs very little change is necessary. The cell or more complicated structure in which

*The molds mentioned in this experiment and in No. 1 seem to be peculiar to this plant. I have carefully examined them, and will describe them further on in a future article.

the male element is found is uniformly termed an *antheridium*; the ciliated fecundating bodies are termed *antherozoids*, those destitute of vibratile cilia *pollinoids*.

For the unfertilized female protoplasmic mass, it is proposed to retain the term *oosphere* and to establish from it a corresponding series of terms ending in *sphere*. The authors propose the syllable *sperm* as the basis of the various terms applied to all those bodies which are the immediate result of impregnation. The entire female organ before fertilization, whether unicellular or multicellular, is designated by a set of terms ending in *gonium*.

The following table exhibits concisely the proposed system in the different classes of Cryptogams:

I. Zygospermeæ. *Zygogonium* containing *Zygosphere*, fertilized *Zygosperm*.

II. Oospermeæ. Male organ, *Antheridium* containing *Antherozoids* or *Pollinoids*.

Female organ, *Oogonium*, containing *Oosphere*, fertilized *Oosperm*.

III. Carpospermeæ. Male organ, *Antheridium* containing *Antherozoids* or *Pollinoids*.

Female organ, *Carpogonium* containing *Carposphere*, fertilized *Carposperm*.

IV. Cormophyta. Male organ, *Antheridium*, containing *Antherozoids*.

Female organ, *Archegonium* containing *Archesphere*, fertilized *Archesperm*.

In the Carpophyceæ the process is complicated, being effected by means of a special female organ which may be called the *trichogonium*; the ultimate result of impregnation is a mass of tissue known as the *cystocarp*, within which are produced the germinating bodies which must be designated *carpospores*. Any one of these impregnated bodies which remains in a dormant condition for a time before germinating is a *hypnosperm*.

In the *Basidiomycetes*, *Ascomycetes* and some other classes, it is proposed to substitute the term *fructification* for "receptacle" for the entire non-sexual generation which bears the spores.—A. P. Morgan.

New Species of Fungi found in Maryland.—Agaricus (Tricholoma) cellaris.—Pileus convex, obtuse, then expanded, fleshy in the center, thin at the margin, silky, smooth, dry, white, more or less stained with umber at the disk; margin sometimes flexuous; lamellæ white, close but not crowded, adnexed, narrow, forked; stipe white, smooth, stuffed with cottony threads, equal, variously branched; spores white, .00024 by .0003 inches; odor and taste pleasant.

Plant five or six inches high, pileus three or four inches broad, stipe one inch thick; cæspitose.

I found this plant in Baltimore, on the fourth of October, growing on a brick wall in a dark cellar. The entire bunch measured more than one-half yard in diameter, and contained twenty-three pilei.

AGARICUS (TRICHOLOMA) BROWNEI.—Pileus convex, then plane, dry, fleshy, densely furfuraceous, ochraceous-brown, looking like soft kid or leather after the bran-like particles fall off; margin striate all the way round, then only at intervals, flesh white, solid, unchanging; lamellæ adnate, forked, not distant, at first pale yellow turning darker in age; stipe hollow or stuffed, squamose, bulbous, penetrating deeply into the earth by a fusiform root; spores white, globose, .00032 inches in diameter; taste slightly saline, but not disagreeable.

Plant ten inches high, pileus seven or eight inches broad, stipe eight lines thick.

In woods near Baltimore, July and August.

It gives me pleasure to dedicate this remarkably beautiful Agaric to its discoverer, Mr. Wm. Hand Browne.

RUSSULA CINNAMOMEA.—Pileus dry, fleshy, centrally depressed, cinnamon color, rimoso-squamose, flesh dry, spongy, tinged with ochre; lamellæ concolorous, narrow, forked, close, sinuate near the margin; stipe regular, smooth, pallid, blunt, at first stuffed, then hollow; spores globose, .00032 inches in diameter; taste acrid.

Plant two or three inches high, pileus four to six inches broad, stipe one inch thick.

In woods near Baltimore, June and July.

RUSSULA VARIATA.—Pileus at first globose, then expanded and centrally depressed, smooth, viscid, variable in color and even variegated, brownish or pinkish-purple, with at times a cast of green, epidermis peels easily, the extreme under margin edged with a delicate line of purple, flesh white, unchanging; lamellæ white, adnexed, narrow, forked, close; stipe white, smooth, more or less tapering at the base, spongy within; spores white, echinulate, .0003 by .0003 inches; taste acrid.

Plant nearly two inches high, pileus three or four inches broad, stipe nine lines thick.

In woods near Baltimore, July.—M. E. BANNING.

BACTERIA THE CAUSE OF BLIGHT.—Recently the writer had the pleasure of hearing a lecture by Prof. T. J. Burrill, Botanist of the Illinois State Board of Agriculture, in which he gave some results of his recent investigations into the cause of Pear Blight. In diseased trees he found the cell sap swarming with *bacteria*, multiplying usually at the expense of the starch contents, accompanied of course by an evolution of CO_2. To test the matter Prof. Burrill inoculated several healthy trees by means of an inoculating needle and in the great majority of cases, within 7 or 8 days the subject would begin to show signs of the Blight.

RECENT PUBLICATIONS.—*The American Journal of Science.*—The December number is mostly made up of a General Index to Vols. XI–XX of the Third Series. During Dr. Gray's absence the Botanical department is conspicuous by its absence.

The American Naturalist.—In the December number the depart-

ment of Botany appears under the editorial management of Prof. C. E. Bessey. The editors of the Naturalist could not have selected more wisely, and we congratulate them upon securing the services of one who will put new and vigorous life into a department too long neglected. A dispermous acorn is described and figured by Prof. Bailey.

Bulletin of the Torrey Botanical Club.—In the November number a *Laminaria*, new to the U. S., is described. Mr. W. R. Gerard describes and figures a viviparous specimen of *Phleum pratense*.

The American Microscopical Journal.—This journal announces a change of type for 1881, which will allow it to put more matter in the same space. We are glad to learn that the editor was so successful during the past year as to encourage him to continue the publication of so valuable a periodical.

The Gardener's Monthly and Horticulturist.—We always turn over the pages of this magazine with the wonder how any one in this country interested in Horticulture can get along without it. It is crowded so full of seasonable hints, editorial notes, science and travel, reports from societies, and first class advertisements, that it is a perfect mine of information to the gardener and horticulturist.

Case's Botanical Index.—This claims to be the cheapest horticultural paper in the world For 50 cents a year it is mailed to subscribers quarterly. It is handsomely printed and illustrated and gives much that is of interest to all classes of botanists.

Vick's Illustrated Monthly Magazine.—The December number contains a very handsome frontespiece, giving on a blue background a picture of a plume of Pampas grass. For hints as to decoration of house or lawn, we know nothing better than this magazine. Many a dreary yard has been beautified by following the simple directions given by Mr. Vick.

The Floras of Cincinnati.—Mr. Davis L. James gives us in this pamphlet a sketch of the Floras of Cincinnati published from 1815 to 1879. It seems that in this time four floras have been published. Mr. Joseph F. James' is the most recent one, and in the present pamphlet quite a number of additions and corrections are made to it. The additions consist of 19 new species and 16 new identifications, principally the work of Mr. C. G. Lloyd, Curator of Botany in the Cincinnati Society of Natural History.

Sexual Variation in Castanea Americana.—This paper, by Mr. Isaac C. Martindale, is a reprint from the last *Proc. Phil. Acad.* It describes among other things a case in which male flowers had become female and produced an abundance of burs. It is sometimes argued that want of nutrition produces such a result, but this Mr. Martindale does not accept.

Erie Natural History Society.—A neat pamphlet of about 30 pages comes to hand, bearing the above title. A glance through its pages shows the President of the society to be a good botanist, G. Guttenberg A history of the society is given and some of its papers published, among which is a very interesting one from Mr. Guttenberg upon the "Poisonous Plants which grow in and around Erie."

COLUMBIA COL...
HERBARIUM
NEW YORK

Botanical Gazette.

Vol. VI. FEBRUARY, 1881. No. 2.

EDITORIAL.—A distinguished botanist has said, "He who demolishes a false species does better service than one who establishes a new one." Of the truth of this there can be no doubt, but the trouble lies in its application. We venture to assert that if there was any way by which such distinguished service could be permanently recorded with the change, as there is when a new species is made, that just as many botanists would be earnestly trying to destroy species as are now eager to establish new ones.

PROF. ALPHONSO WOOD died at his home at West Farms, N. Y., January 4th, at the age of 71. Prof. Wood's name is known throughout the country wherever the science of Botany is studied. His Textbooks and Manuals were very popular and found a warm reception in very many schools and botanical libraries. His whole object in arranging and describing species seemed to be to make it easy for beginners to find the names. While, of course, no such thought should enter into the writing of a strictly scientific description, it is very refreshing to the puzzled student sometimes to turn from such a one to another from which all difficulties have been cleared away and characters used that any one can see It was for this reason that Prof. Wood's books found such ready sale and such probably was the sole spirit of his work. As a scientific botanist his work can never rank very high, but as an educator his name will always be remembered.

A NOTE IN *Nature* says that a plant recently introduced by accident into Queensland (*Xanthium strumarium*) is giving trouble to the colonists on account of its poisonous effects on cattle. Extract of the plant being administered for experiment produced torpidity gradually increasing till without struggling or excitement the breathing ceased, after which the heart's action became feeble and stopped. From smaller doses the animals recovered. Extracts of *X. spinosum* gave similar results. Does any one know whether cattle in this country eat these weeds, and if so, whether any ill effects are noticeable?

M. HENRY POLONIE has advanced the theory that the gritty particles near the core in pears and allied fruits, called sometimes "stone-cells," are the rudimentary remains of a stone enclosing the seeds of some ancestor of our present pears. The theory is supported by the fact that a series of fruits can be made in which there is a regular gradation from almost no stone-cells to where they are in contact and form a kind of casing for the seeds; and also some related genera have stony fruits.

PROF. W. W. BAILEY is preparing a "Botanical Collector's Handbook," which is to be published by Geo. A. Bates of Salem, Mass.,

and issued in the early spring. There could be no one better fitted for giving directions for collecting and preserving plants than Mr. Bailey, and aided as he is by others who have had long experience, the book will undoubtedly be all that it claims. Such a work has never been published in this country and when it has come into use botanical collectors will wonder how they ever did without it. To secure copies early and promptly orders should be sent on to the publisher at once. The price is $1.50.

BERNARD QUARITCH, 15 Piccadilly, London, is advertising three very rare and costly botanical works. They are Elwes' Monograph of the genus *Lilium*, in 7 parts, royal folio, colored plates of every known species of the genus, for £7, 7*s*.; Clarke's Commelynaceæ et Cyrtandraceæ Bengalenses, royal folio, 95 plates, for £1; Boott's Illustrations of the Genus Carex, 4 vols. folio, 600 plates, for £21.

OUR EXCHANGE DRAWER is filled this month with a lot of publications that are very common in this enterprising country. There are "Floral Cultures," "Floral Instructors," "Floral Albums." "Horticultural Reviews," etc., etc., all printed on flimsy paper, with wretched typography and still more wretched matter, yet all claiming to be indispensable and authoritative. Scraps of doggerel, senseless correspondence and sickly sentiment go to make up the contents of these valuable periodicals. How people can be deluded enough to publish such stuff, or, still worse, subscribe for it, is more than we can understand.

CAREX SULLIVANTII, Boott., A HYBRID.—During the past twelve months I have distributed a considerable number of *Carex Sullivantii* among U. S. botanists, at first without suspecting it to be other than a true species, but later with the honest conviction that it is a hybrid. My views were communicated to Prof. Gray in June last, and he urged me to make them public, which is the object of this communication.

This pseudo-species was discovered by Sullivant, at Columbus, Ohio, nearly forty years ago, in one small spot growing with *C. gracillima* and *C. pubescens*. Its barren perigynia led him to suspect it might be a hybrid between these two species. He subsequently transplanted it into his garden, where he watched it for several years, but could never find mature achenia. Dr. Boott says "achenia abortive."

Dr. S. H. Wright, (Penn Yan, N. Y.,) to whom I am indebted for the above *resume*, adds: "I think you are the only person who has since found it; and, as the abortive fruit in your plants makes your experience with it the same as Sullivant's, together with the fact that it has lain nearly forty years before re-discovery, renders the conclusion, that it is a hybrid, a pretty safe one."

The re-discovery of this plant was in June, 1879. I found it in a low meadow near the bank of a swampy stream, in the midst of *C. gracillima* and *C. pubescens*. That it partakes of the character of both these species there can be no doubt whatever. Of the former are its spikelets, of the latter its perigynia, though smaller. At flowering

time the stigmas are well developed, but not sufficiently glutinous to hold pollen. The anthers are exceedingly small, and show no signs of dehiscence until about two weeks after the stigmas are dry, at which time the pollen is shrunken, and apparently lifeless. If the grains examined contained fluid, it escaped detection. Frequent observations of the plant in its habitat were made, as well as a close study of its essential parts under the microscope.

The foregoing facts seem to lead to but one conclusion, namely, that the plant is a hybrid.—E. C. HOWE, *Yonkers, N. Y.*

CARNIVOROUS PLANTS. III.—EXPERIMENT No. 6.—Placed upon a leaf, which had had the sunlight during the morning, a larva (same as in No. 5), at 2 P. M., June 6, '79.

20 min. the submarginal t. nearest the specimen had approached and touched it; the marginal t. on one side had moved through an angle of 45°.

80 " continued movement of those t. nearest the larva, many being closed upon it; no further change was perceptible in the marginal t.

112 " the submarginal t. opposite those mentioned before, have moved considerably; movement among the disk t. perceptible.

3 hrs. no change from the last.

20 " considerable movement among all the t; the submarginal mostly closed upon the specimen; all but about 6 or 8 of the marginal bent over toward the object.

22 " about the same as the last.

29 " all the submarginal, the edge of the leaf nearest the specimen, and some of the marginal t. much inflected.

67 " no change.

73 " a slight reflex action is noticeable.

94 " the marginal and submarginal t. were wholly reflexed; disk t. partly so.

109 " completely reflexed.

126 " leaf with secretion on the t.; perfectly natural.

EXPERIMENT No. 7.—Placed upon a leaf, which had had sunlight during the forenoon, a minute piece of wood at 2 P. M., June 6, '80.

20 min. 10 or 12 of the submarginal t. were inflected, and three or 4 of these touched the specimen.

80 " some further movement of the submarginal t. on one side; elsewhere no perceptible change; a few t. situated on the petiole had moved somewhat.

112 " the submarginal and disk t. had moved but little from the last.

3 hrs. no change from the last.

20 " no perceptible change.

29 " an apparent reflex action, although slight.

69 " all the t. were reflexed.

84 " leaf with secretion on the t.; perfectly natural.

EXPERIMENT No. 8.—Placed a cube (edge 1-16 inch) of hardened egg albumen upon the disk of a leaf, at 2.45 P. M., June 10, 1879.

30 min. perhaps there had been a slight movement of the disk tentacles, but none of the others showed any change.

2 hrs. evident movement of the disk tentacles.

17 " the edge of the leaf and all of the disk, submarginal and marginal tentacles were inflected and touched the specimen, except the tentacles and edge of the leaf on one side for about one fourth of the circumference.

24 " all the tentacles except five or six of the marginal, and the entire edge of the blade, were inflected*; egg all softened, opaque but not viscid.

41 " entirely closed except two of the marginal tentacles.

47 hrs. several of the marginal tentacles were reflexed; a soft and viscid semi-fluid substance is all that remains of the egg.

67 hrs. the marginal tentacles, with the exception of two or three, were standing at an angle of 90° with the blade, the sub-

*The margin of the blade of the leaf is often more or less incurved, according to the substance undergoing absorption; apparently if the matter is easily absorbed the whole leaf seems to be excited and all parts are brought into action. In this case, however, the method of incurving was somewhat peculiar, and I am not aware that it has ever been recorded. When fully inflected the blade was pentagonal in outline. (Fig. 1.)

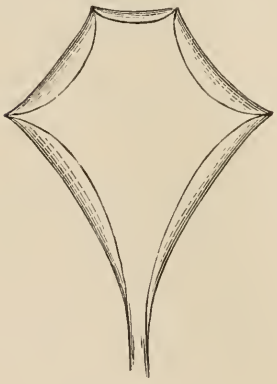


FIG. 1. (3X)

To the intense exertion on the part of the leaf to assimilate all the absorbable matter contained in the substance placed upon the disk; to the undue excitement caused by an over-dose of an easily absorbed food, I am led to ascribe, as the direct cause, the death of the leaf, noted at the end of the experiment.

Three other forms of marginal incurvation are mentioned by Darwin. [Insectivorous Plants, p. 12.]

"For instance, I placed bits of hard-boiled egg on three leaves; one had the apex bent towards the base; the second had both distal margins much incurved, so that it became almost triangular in outline, and this perhaps is the commonest case; while the third blade was not at all affected, though the tentacles were as closely inflected as in the two previous cases. The whole blade also generally rises or bends upwards, and thus forms a smaller angle with the foot-stalk than it did before. This appears at first sight a distinct kind of movement, but it results from the incurvation of that part of the margin which is attached to the foot-stalk, causing the blade, as a whole, to curve or move upwards."

stance remaining of the egg adhering to them as a white opaque mass.

74 hrs. the same as the last except the substance on the tentacles has turned brown.

91 " the marginal tentacles were all reflexed except those on one side where they were held by the viscid substance mentioned above.

98 hrs. all the submarginal tentacles, for at least one half the circumference, standing at an angle of 90° with the blade.

137 hrs. the tentacles were nearly all reflexed, and those that were not were simply held back by the remaining substance of the egg.

148 hrs. the leaf was expanded but somewhat stuck together in parts by remains of egg; the leaf seemed almost lifeless; the tentacles were shrunken and with no secretion; however, *the remainder of the plant seemed to be in a more thriving condition than at the opening of the experiment.*

186 hrs. the substance on the leaf had become fibrous; leaf fully expanded; no secretion.

195 hrs. the leaf on one side was so covered with the fibrous substance, mentioned in the last note, as to appear quite dead.

220 hrs. the leaf was, apparently, rapidly dying.

316 " the leaf was completely dead and covered with a mold.*

An Easily Made Observation.—Several years since I constructed a couple of simple machines for measuring the longitudinal growth of plants which were so effective for work and so easily made withal that it may be well to describe them for the benefit of pupils who may wish to make some experiments. They were essentially the same as the arc indicator described by Sachs in his Text Book. My arc indicators consisted of square pieces of manilla paper tacked to suitable frames; upon these arcs were described and divided into spaces of 5° each. At the centers small pulleys made of perfectly round sections of corks were placed and so arranged as to revolve with the utmost ease. By properly fastening a strip of manilla paper to the large square piece, the cork pulley was easily held in place by a pin passing through the strip and exactly through the center of the cork and the center of the arc, the pin turning in the paper supports, but being fixed in the cork. To the cork a delicate finger made from a straight "splint" of a common corn broom, was attached to serve as an index. A silk thread to be attached to the plant whose growth was to be observed was wound once around the pulley, and to the free end a weight heavy enough to little more than counter-balance the index, was attached.

It took but little longer to make these two instruments than it has taken me to describe them. I immediately put them in place twelve inches or so above a couple of young bean seedlings (*Phaseolus* sp.)

*The same as the mold spoken of in a previous foot-note.

growing in my study window, and for a week watched them and noted results. I made a careful observation four times every twenty four hours, viz: at 8 A. M., 12 M., 4 P. M., and 8 P. M. Indicator No. 1 was attached to a very young internode, while No. 2 was attached to one which had already elongated somewhat. The silk thread was carefully looped under the bases of the leaf stalks at the summits of the internodes, in such a way as not to produce a constriction of the stem. The record was kept in degrees of the arcs, and was transferred to profile paper, the horizontal distance representing time and the vertical the aggregate growth. In this way instructive diagrams were obtained for study and comparison. It was at once evident that the curve of growth for the day was much steeper than that for the night, the percentages ranging from day growth 59.6 and night growth 40.4, to day growth 52.2 and night growth 47.8. These figures can convey scarcely any idea of the constant and marked difference between the day growth and night growth as shown in the curve of growth upon the diagram. By modifying the attachment of the thread, by attaching several instruments to different internodes of the same plant, or by varying the treatment of the plant, as by increasing or decreasing the temperature, or the amount of water supplied to it, the pupil will be able to find out many interesting things about the growth of plants, with a little outlay of time, and none at all of money for apparatus. — C. E. BESSEY, *Ames, Iowa.*

TRICHOSTEMA PARISHI, Vasey. — Shrubby and much branched below, 2–3 feet high, canescently puberulent; leaves sessile, lance-oblong, 1–1½ inches long, tapering to a narrow base, obtuse, sparingly tomentose beneath, with fascicles of linear leaves with revolute margins in the axils; floral leaves 1 inch, gradually reduced to bracts. Thyrsus 6–12 inches long, lower cymules 1–1½ inches apart, closer above, each consisting of 5 to 8 flowers, the peduncles 2 to 4 lines long, pedicels about 2 lines, the purplish wool of calyx scanty compared with *T. lanatum*. Corolla 5–6 lines long, the lower lobe rather longer than the upper, filament 9–12 lines long.

Differs from *T. lanatum* in the shorter and broader leaves, longer and more slender thyrsus, with the cymules more open and much less woolly, the flowers smaller and filaments shorter.

Named for Mr. S. B. Parish, of San Bernardino, Cal., one of the discoverers. Found in San Diego Co., Cal., by *Mr. S. B. Parish* and *G. R. Vasey*. — GEO. VASEY.

BOTANY OF CALIFORNIA, VOL. II, by Sereno Watson. — The authors of this great work are to be congratulated upon its successful completion. The dress is admirable, with fine paper, clear type and broad margins, doing credit even to the famous University Press. The appearance of such a work always makes a stir in botanical circles, for it is a partial record of the progress of systematic botany up to the date of going to press. It is with peculiar satisfaction that we welcome this second volume, for it marks a completed work, and

our shelves are too much filled by those that are incomplete. Works upon Polypetalous orders are multiplied; Gamopetalæ have less of a showing; while Apetalæ and Monocotyledons are really poverty stricken. For some years hence our systematists in beginning their great works should scrupulously begin with Endogens and write their last volume first. The present volume carries the flora of California not only through Monocotyledons, but through Mosses. No state is so well provided with a botany as California, but it does not follow that all states should follow her example for it would be a useless expense and multiplication of books. No other state so well deserves a separate and complete botany. It naturally includes our whole Pacific coast and thus is the flora of a very distinct geographical area.

As usual the work of the volume has been parcelled out among specialists, Mr. Watson bearing the chief burden. Most of the changes in nomenclature have been made and the new species described before the issue of the present volume, being recorded in the proceedings of different scientific societies. But this sort of information is much scattered and the grouping together of the little changes of years gives a proper impression of the amount of work that has been done, and puts it into a usable form.

We will note some facts and changes that catch the eye in a hasty turning of the leaves, changes that for the most part are original with this volume.

Polygonum amphibium, var. *terrestre* becomes *P. Muhlenbergii*. Of the 102 known species of *Eriogonum*, 55 have already been found in California. Two species belong to the South Atlantic States, two to Mexico and the rest of the genus is found between the Mississippi and the Pacific.

Chenopodium is made to include *Blitum*, and *B. maritimum* of the Manuals is *C. rubrum*.

A near relative of *Dirca palustris* has at last been found and called *D. occidentalis*. Our Sycamore is represented in California by *P. racemosa*. Several new Euphorbias come from the safe hands of Dr. Engelmann, who also now recognizes as species what ranked before as varieties of *Quercus lobata* and *Q. chrysolepis*. These new oaks bear names that repeatedly appear in California botany, viz.; Drs. Brewer and Palmer. *Taxaceæ* apper as an order distinct from *Coniferæ*, and *Abies* is so broken up that for a time we can hardly get our bearings. For *Abies Douglasii* we must say *Pseudotsuga Douglasii*; *Abies Menziesii* is *Picea Sitchensis*; while other well known species of *Abies* appear under the generic name of *Tsuga*.

The abundant and well known *Pinus ponderosa* of the Rocky Mountains is now only the variety *scopulorum* of the true *P. ponderosa*. Out of eight Californian Habenarias Mr. Watson names six, and out of the 23 Alliums, 15 must look for their author to the same indefatiguable worker.

The many changes and additions among the *Liliaceæ* were fully noted in the GAZETTE for August, 1878, in a review of Mr. Watson's "Revision of N. A. Liliaceæ."

The "Skunk Cabbage" of California rejoices in the name of *Lysichiton Kamtschatcensis*.

Lemna Torreyi of the Manual is *L. Valdiviana*, Philippi; and we are reminded that *L. polyrrhiza* was long since changed to *Spirodela polyrrhiza*.

Two genera of palms are described, *Washingtonia* and *Erythea*.

Of the genus *Carex* we find 78 species, some 10 or 11 being described here for the first time by Mr. Wm. Boott.

We confess to a good deal of interest in looking over the *Gramineæ* by Dr. Geo. Thurber. Not so many changes appeared as we had anticipated and we were glad to see that the ordinary terms were employed and not those involving theoretical views of the structure of the flowers. Several new species are well distributed among as many genera. *Brizopyrum spicatum* appears as *Distichlis maritima*.

Ophioglossaceæ appears as an order distinct from *Filices*. The progress in our knowledge of the classification of Ferns has been noted from time to time in reviews of Prof. Eaton's great work.

The genus *Azolla* instead of, as usual, appearing under the order *Marsiliaceæ*, is separated under the order *Salviniaceæ*.

That the flora of California has not been exhausted is witnessed by the fact that during the four years that have elapsed between the publication of the two volumes, new material enough has been collected to make over 60 pages of "Additions and Corrections." In these 60 pages of course we find the very latest information. The California *Trautvetteria* is made a distinct species and now the genus stands with three species, one on the Atlantic coast, one on the Pacific, and one in Japan. A new species is described under *Dicentra*, *Corydalis*, *Trifolium*, *Rosa*, while *Draba* has three additions. A new genus of *Cruciferæ* is dedicated to Mr. Leland Stanford, one of the patrons of the "Botany of California." It is called *Stanfordia*. A good many *Compositæ* are added, largely the result, we suppose, of Dr. Gray's recent study of that vast order. On page 485, *Erythea*, Mr. Watson's genus of Palms, is unfortunately printed *Erythrea*, which makes it look too much like *Erythræa*.

All botanists should possess this complete work which is exceedingly cheap when we consider the matter and workmanship. By addressing Mr. Sereno Watson at Cambridge, Mass., botanists can procure either or both volumes at $5.00 each. – J. M. C.

Francis Darwin on Physiology of Plants.—Abstracts of two important papers read by Francis Darwin before the Linnean Society, appear in *Nature* for Dec. 23.* "Both bear on the relationship between the external and internal conditions of life, between external forces such as light and gravitation, and the constitution of the organism on which these forces act."

I. The behavior of leaves under the action of light may be illus-

*I. "The Power possessed by Leaves of placing themselves at Right Angles to the Direction of Incident Light." II. "The Theory of the Growth of Cuttings, illustrated by observations on the Bramble, *Rubus fruticosus*."

trated by the cotyledons of the seedling radish. If illuminated from above they take a horizontal position, standing thus at right angles to the light. If lighted obliquely from above one becomes depressed and the other elevated, so as to assume again the position at right angles to the incident light.

The two theories which have been proposed to account for this tendency bear the names of Frank (1870) and de Vries (1872), the latter endorsed by Sachs, with modifications, in 1879. Frank supposes a certain sensitiveness to light, which he calls "transverse-heliotropism," to be an inherent tendency in leaves and some other parts of plants, which causes them to assume a position at right angles to light, just as heliotropism inclines them to parallelism with the rays. A similar difference is shown in the tendency of aerial stems to grow upward, and of rhizomes to grow horizontally.

De Vries considers that the ordinary forces of heliotropism and geotropism may so balance each other as to keep horizontal the leaves of a plant lighted from above. Modes of growth may also assist in maintaining this equilibrium. For instance epinasty may be opposed by heliotropism and hyponasty by geotropism.

Darwin's experiments were made with a view to test these two theories. In order to be rid of the disturbing element, the force of gravitation, he used the klinostat, an instrument in the use of which the plant is fastened to a horizontal spindle and illuminated from the direction of the axis. By clockwork the spindle is kept in steady but slow rotation. If a plant which has been previously illuminated from above be fastened with its axis parallel to the axis of the klinostat, and the direction of the incident light, according to Frank's theory the leaves ought to remain stationary, but according to de Vries and Sachs they ought *not* to be able to retain the rectangular position. The results with *Ranunculus ficaria* were decidedly in favor of Frank's theory. The leaves of this plant, which are sometimes extremely epinastic, moved forward until approximately at right angles to the light and then came to rest. Again, when the plant had been placed in the dark so as to compel the leaves to point upwards, and then placed on the klinostat, the leaves turned backward till again at right angles.

A series of experiments with seedling cherries seemed to lead to a somewhat different result. When placed on the klinostat the leaves were unable to keep their horizontal position, but became parallel to the stem of the plant.

He concludes that transverse-heliotropism is really the important influence at work, and that this sensitiveness to light is sufficiently strong in the case of the Ranunculus to determine the position of the leaves, notwithstanding the annihilation of heliotropism. The cherry, when growing normally, he believes to trust to the approximate equilibrium between epinasty and heliotropism, which is made complete by the influence of light. "But when the balance is disturbed by placing the plant on the klinostat, the light stimulus is not strong enough to produce a condition of equilibrium."

II. The second paper considers the two theories to explain the tendency of cuttings to produce roots near the *basal* end,* and buds near the *apical* end. Vochting ("Organbildung im Pflanzenreich," Bonn, 1878) believes this tendency to be innate, and growth-inherited. Sachs, in a late paper (Arbeiten des bot Inst. Wurzburg, 1880, p. 452) opposes the theory of Vochting *in toto* and conceives that Vochting's morphological force is really a tendency impressed upon the forming cells by the action of external agencies, especially that of gravity.

Darwin observed carefully the rooting of the species of the sterile shoots of brambles growing on steep banks. In such positions the majority of the branches grow immediately downward or straggle out horizontally and then turn downward. But some grow uphill, yet he finds the tips of many of these branches, indifferent as to position, taking root. The gravitation impulse therefore seems not to be applicable to such a case. Mr. Darwin then proceeds to show that it is better for the plant that the morphological growth-impulse should determine the formation of roots at the tip than that root formation should depend on the guiding force of gravity. Injury is most likely to occur at the end of the branch. The new shoot that is to be produced to perform the function of the original branch will have the best chance of success if it starts from the point reached by that branch before the injury; therefore the growth of the bud nearest the apex is the most advantageous for the plant.

It must be remarked that some of the conclusions drawn, if Mr. Darwin is correctly reported by *Nature*, do not seem warranted by the result of the experiments, but it would be hardly just to criticise a paper from a mere abstract.– C. R. B.

PERONOSPORA VILICOLA, DeBary.—American grape vines having been introduced into Europe, with the expectation that they would better withstand the attacks of *Phylloxera*, have carried this parasite with them, and within two years it has spread over all the vine growing countries.

It was first found in Hungary in 1877; in 1878 in South-western France; in 1879 it occurred in a number of provinces, and in 1880, everywhere, doing immense damage. In 1879 it was discovered in Italy and Switzerland, and in 1880 in Tyrol, Steyermark and Lower Austria. *Vide Hedwigia.*– E. W. HOLWAY.

A NEW GRASS.—While on a botanical trip with my friend H. N. Mertz around Lake Chautauqua, N. Y., last summer, we found on a road at Fairpoint upon the "Association grounds" a grass which puzzled us considerably. It was an annual with tufted, linear root leaves 4–5 inches long; slender, leafy culm 15–18 inches high, ending in a narrow spike about two inches long, consisting of numerous 5–6 flowered spikelets each enclosed *within two ovate pinnately-divided bracts* (*glumes?*).

*That end originally nearest the body of the parent plant.

Satisfied that this must be a recently introduced grass I sent a specimen to Dr. Geo. Thurber who considers it an important find. It is *Cynosurus cristatus*, Linn., the "crested dog tail grass," rather common in Europe, but heretofore not reported in the U. S.

Botanists who visit Chautauqua this year are requested to be on the lookout for this grass in order to ascertain whether it can hold its own and can be considered as thoroughly established.—G. GUTTENBERG.

PODOPHYLLUM PELTATUM.—I believe the May-apple is exclusively a native of North America, but it is found in great profusion from the northern to the southern boundaries of the United States. Now it is precisely because this plant is so very common that nothing is said of its beauty or virtues. Why it has been given the name of May-apple would be difficult to conjecture, as it rarely blooms before June, but occasionally I have found it blooming about the end of May. It delights in moist, rich soil, and is always most luxuriant in damp, shady woods. Its fruit is never ripe until the latter part of September, and indeed the plant is propagated so abundantly by the creeping of its roots, that Dr. Barton says only a small proportion of its flowers produce fruit. What the cause of it is I do not pretend to know, but the fact remains the same, that while I am well acquainted with the flowers of this plant, I have never seen the fruit more than once or twice. In May 1879, I noticed large patches of its light green leaves above, and pale beneath, supported on yellowish green stems about a foot high. Later on when the plants are in flower, the drooping habit of these blossoms found in the fork that the junction of the petioles makes, gives to the whole bed an elegant appearance. The number of its white petals varies from six to nine, and they are thickly laced with vein. The pistil is of a yellowish color, and crowned by a stigma much darker. The stamens vary from thirteen to twenty, and are yellow. The fruit that I have seen was small and about the color of a half ripe lemon, but Dr. Barton says, "the size varies according to the different situations the plant may have been grown in, and when mature is lemon yellow slightly maculated with round brownhsh dots."

The proper time for collecting the roots for medicinal purposes is after the leaves have fallen. Porcher says in his "Resources of the Southern Fields and Forests," that the pulp of the fruit when squeezed into a wine glass, and with the addition of sugar and old Madeira, is said to be equal as a drink to the luscious golden granadilla of the tropics. Many people like the taste of the fruit when eaten, without other flavor than its own.—E. HUNTER, *Essex Co., Va.*

RECENT PERIODICALS.—*The American Naturalist* for January is strong in Botany. Mr. William Trelease has been studying the Fertilization of *Calamintha Nepeta* and finds it cross-fertilized by many insects, though capable of close-fertilization in one or two unlikely

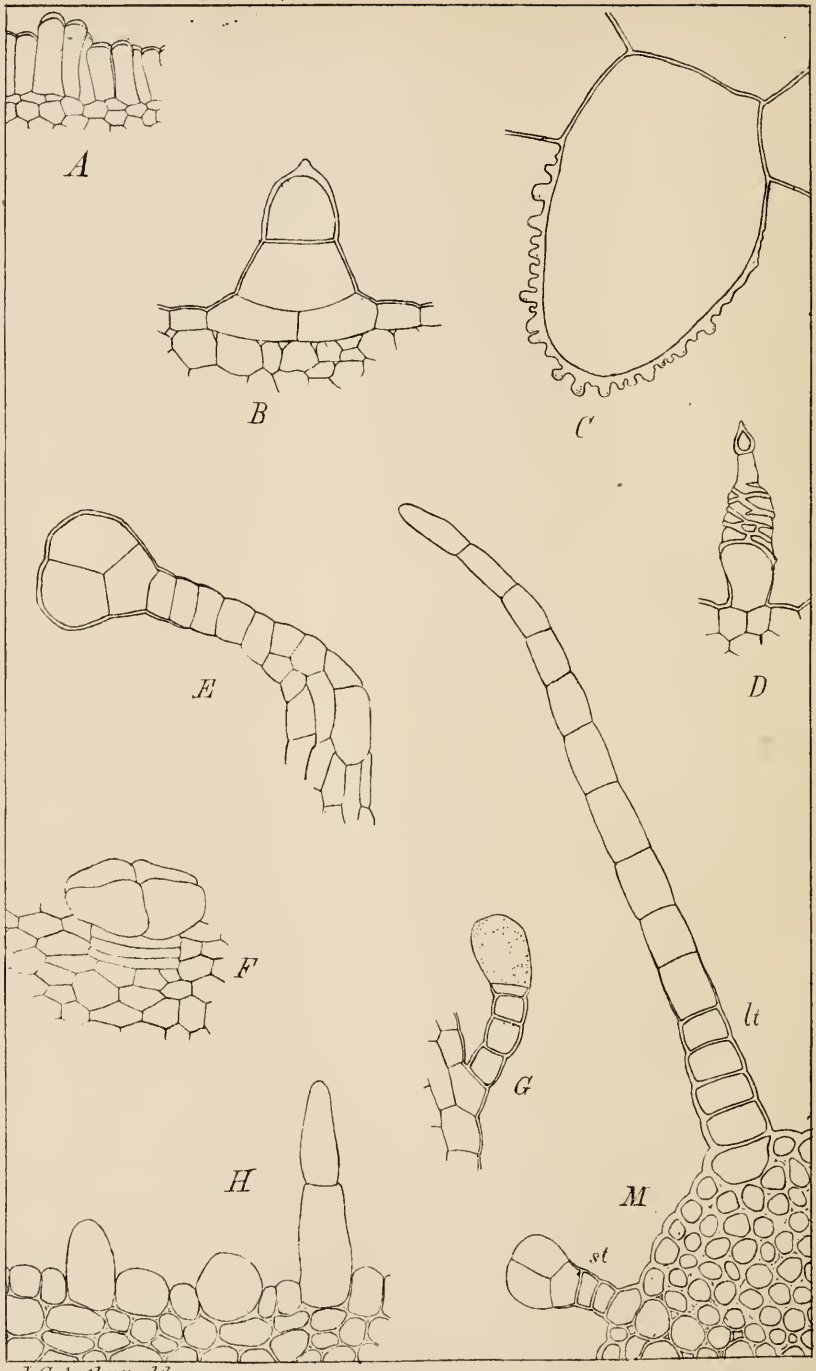
ways. The flowers are not fully proterandrous, as the stigma becomes receptive while some pollen still remains in the anthers. Protection against "unbidden guests" is afforded by the fine pubescence on stem, leaves, calyx and corolla, while a dense *chevaux de frise* of hairs guards the corolla tube. Rev. E. L. Greene gives his second paper on "Botanizing on the Colorado Desert," in which he makes one desirous of possessing the desert plants but not of collecting them. Prof. W. J. Beal has an illustrated article on the "Method of Distinguishing Species of Populus and Juglans by the Young Naked Branches." The suggestions are good and the thing seems perfectly practical and wonderfully convenient.

Bulletin of the Torrey Botanical Club appears for January in a new cover and with a general appearance of enterprise. A plate accompanies Mr. Francis Wolle's article on New American Desmids. Prof. Eaton has the ninth installment of "New or Little Known Ferns of the U. S." Mr. E. L. Greene describes a new *Asclepias* from Arizona.

The Monthly Microscopical Journal for January shows also marks of improvement in smaller, clearer type, giving a pleasanter appearance and more matter. Every botanist who works with the compound microscope should not fail to subscribe for this Journal.

CATALOGUE OF THE FLORA OF INDIANA.—With this number of the GAZETTE we begin issuing in the form of extras a catalogue of Indiana plants. When no range is indicated the plant occurs throughout the state. When the term "North" or "South" is used, the plant has been found in the northern or southern part of the State. In other cases there is given simply the names of counties from which the plant has been reported. Of course many Indiana botanists will see that counties have not been credited that should be, but we have on hands no proof that the plants grow anywhere but in the places mentioned. Possibly this manner of publication will bring us the desired information, for botanists often begin to send notes after publication has been begun. We would call on them again to send any names or specimens they may possess that all additions necessary may be made in the closing pages. Whenever a new name is sent to be inserted in the catalogue a specimen should always accompany it. A moment's reflection will show the necessity of this in making an authoritative catalogue. Every name in the catalogue should stand for an actual specimen, a specimen that can be produced for examination at a moment's notice. While we do not doubt that many botanists in the state are as competent to pronounce upon a specimen as we are, the line must be drawn somewhere or we would be overwhelmed with spurious names and the catalogue become worse than useless. It is to be distinctly understood then by botanists in general that this catalogue stands ready with its proofs in every case.

COLUMBIA COL
HERBARIUM,
NEW YORK.



J. C. Arthur, del.

ARTHUR ON TRICHOMES.

COLUMBIA COL.
HERBARIUM,
NEW YORK.

Botanical Gazette.

Vol. VI. MARCH, 1881. No. 3.

Various Forms of Trichomes of Echinocystis lobata.—In reexamining recently the results of a study of the anatomy of *Echinocystis lobata*, Torr. & Gr., made some years ago, my attention was attracted to the variety of shapes which its trichomes assume. The diversity is the more unexpected because the plant is "nearly smooth,"* speaking accurately, and what pubescence there is would usually be overlooked.

Of course, the roots near their tips are provided with the well known, delicate, one-celled root-hairs, which are so abundant and long that when a plantlet is pulled from the ground it brings with it quite a weight of soil.

Few hairs are found on the stem except at the growing extremities. In these places they are numerous, and of two shapes—filiform and capitate. Individually they are minute and delicate although forming a slight pubescence when taken as a whole. They are so evanescent as to rarely persist after the growing point of the stem has extended a few centimeters beyond them. The filiform hairs (Pl. I, M, lt) are composed of a single row of terete cells, in which movements of the protoplasm may often be detected under favorable circumstances. They arise from above a hypodermal tissue of collenchyma. The capitate form (Pl. I, M, st) springs from a parenchymatous hypodermal tissue containing chlorophyll. They are much shorter than the first, and consist of a head of two or four large cells side by side supported on a stem of smaller cells. They are more abundant than the filiform ones but less persistent. In general, taking the whole plant into consideration, the filiform ones occur upon projecting portions of the surface, the ridges and edges, which are firm and without stomata: such are the margins of the leaf, the angles of the stem, and the edges of the perianth-cup. There are two exceptions to the rule, for they are also found sparingly both on the flat surfaces of the leaf, and on the exterior of the perianth-cup. The capitate form springs from stomatic surfaces, e. g. channels of the stem, upper and under surfaces of the leaf, exteri r of the perianth cup, etc., while within the perianth cup, and on the petals are modified forms (described below) of the same type.

Full grown leaves are minutely scabrous upon both surfaces from the presence of short, thick, and rigid trichomes, which are sometimes tipped with a minute mucro (Pl. I, B).

A very copious supply of delicate glandular hairs (Pl. I, G) upon all sides of the petals gives to them a soft velvety appearance.

*Gray's Manual, 5th ed., p. 186: "nearly glabrous," Fl. North Amer., Torrey & Gray, v. 1, p. 542

The inner surface of the perianth-cup has numerous flat-heaess-trichomes (Pl. I, F), which have the cells of the short stalk comprded ed vertically like circular plates, and the four or six slightly inflated cells, which at first compose the head, often changed into a head of many cells by formation of vertical, radial partitions. In the closely related *Sicyos*, these flat-headed trichomes are so densely pressed together over the bottom of the cup, that in a cross section it appears at first sight to have a second undulating epidermis supported on short pillars.

Each one of the prickles of the young ovary is tipped with a solitary trichome (Pl. I, E), like the capitate ones of young shoots, but much larger, so large in fact that they can be discerned by the unassisted eye. These disappear soon after fertilization, while the prickles continue to grow. The calyx-teeth and the lobes of the very young leaves, which have the same histological structure and appearance as the prickles on the ovary, are not thus equipped.

There are scattered some trichomes of peculiar form among the sort next mentioned. They consist of one comparatively large cell with reticulated thickenings (Pl. I, D), tipped with a small pear shaped cell. They are straight and rigid but rarely stand upright owing to a weak base.

All the free surface of the connectives, i. e. the surface of the anthers not occupied by the thecæ, both at the apex and sides has the epidermal cells produced into incipient trichomes (Pl. I, A). Their origin and form, and the fact that they are not united laterally, entitle them to this classification. The slight cuticularization of their apices, and total absence of ordinary epidermal cells indicate their near alliance with true epidermis.

A still more curious transitional form is presented in the epidermal tissue of the upper surface of the cotyledonary petioles (Pl. I, H). The epidermis, which is underlaid with a hypoderma of firm collenchyma, presents the anomaly of not being cuticularized. Its cell-walls continue an unequal growth and meeting no outward resistance expand their free surfaces pilosely. The longer cells divide and become several-celled filiform trichomes. In *Cucurbita* the cotyledonary petioles, having the usual cuticularized epidermis, are extremely short, and entirely distinct from each other; *Echinocystis* has the petioles longer and slightly connate; while *Megarrhiza* has very long petioles which are connate throughout, forming a tube. It seems quite reasonable to presume that the upper (inner) surfaces of the cotyledonary petioles of *Megarrhiza* will be found upon examination to be still more strongly pilose by transformation of the epidermis, than those of *Echinocystis*, because of the more perfect protection from environmental influences.

The last example shows a natural transition to trichome-like outgrowths arising from a surface without epidermis. Such were found (Pl. I, C) projecting into the central cavity of the hypocotyledonary stem of an old plant. The wind had twisted the stem so as to rupture it and expose the inside to the weather. Some of the cells of the in

ner surface had expanded, under these changed conditions, into corpulent pseudo trichomes with irregularly thickened walls.

Still more remotely related to true trichomes are the hernioid cells* found in the large vessels of the older roots. They are formed by the local surface growth of a cell-wall lying in contact with a pitted duct, so that the cell-wall, aided by pressure of the cell contents, is forced through the opening of the pit into the cavity of the duct, where it makes a bladder like expansion.

Ovules are in some species of plants considered to be metamorphosed trichomes. But such is evidently not the case in this instance, for the reticulated venation, characteristic of Cucurbitaceous seeds, shows them to be unequivocably homologous with a portion of the leaf-blade.

All the forms mentioned in this article fall under one of two classes, capitate or filiform. Trichomes of the former class are inclined to be glandular while those of the latter are not. This accords well with their distribution over the plant surface. The filiform ones contain the more highly vitalized protoplasm, as manifested by its activity. They are situated on the parts of the plant which are destitute of stomata and growing rapidly, and consequently in need of some other means of directly absorbing water and oxygen from the atmosphere and soil. On the other hand the capitate forms are on surfaces well provided with breathing-pores. The latter serve to absorb oxygen during the earlier stages of growth, while the stomata are inefficient. When the stomata perform their allotted function, and the intercellular spaces are free of sap and protoplasm, these capitate trichomes become glandular and are turned to other service, or disappear.

Considered physiologically, trichomes are not indispensable to the plant, yet in a small way frequently render important assistance. The value of the root hairs is one of the best known facts in Botany, being uniformly illustrated in general treatises, and insisted upon in horticultural essays on transplanting. Hairs on many plants serve for protection against detrimental changes of the weather, the attacks of animals, etc., but in *Echinocystis* the only trichomes that could be considered protective are those which roughen the leaves. Upon rapidly growing parts (especially true, e. g., of young flower buds) the abundance of delicate trichomes aids in supplying oxygen to the tissues. Stomata and air cavities perform this office in the older portions, but in parts newly formed the cavities are filled with protoplasm and cell sap, so as to prevent free circulation of air. Moreover, a very rapid supply of oxygen is required at this time to meet the needs of metastasis by which the increase of protoplasm and the formation and multiplication of cells is effected. The oxygenation of the plant in such growing parts is somewhat analogous to that of some polyps and worms having external filamentous gills, while later it assumes the more efficient internal respiration corresponding to that of insects.

It has already been hinted that there is a similarity of function between the hairs of growing shoots and of young roots. Both subserve

*Illustrations of these are given in Bessey's Botany, p. 30.

the interests of the plant by increasing the surface through which material for the plant's sustenance and growth may be absorbed. The character of such material is determined by the nature of the respective media in which the organs vegetate —of shoots it is gaseous, of roots aqueous.—J. C. ARTHUR, *Univ. of Wis.*

EXPLANATION OF PLATE.—Trichomes of *Echinocystis lobata*, Torr. & Gr.: drawn with camera lucida; uniformly magnified 250 diam.

A. Vertical section of androecium; the epidermal cells transformed into trichomes.

B. Short rigid hair from surface of mature leaf.

C. Cell from interior surface of an injured hypocotyledonary stem; free portion of the cell-wall irregularly thickened; a pseudo-trichome.

D. Reticulated trichome from surface of androecium.

E. Capitate trichome on the point of a prickle of the ovary; inclined to one side, as is common.

F. Flat-headed trichome from interior surface of perianth-cup; seen in perspective.

G. Trichome from surface of petal; its head somewhat glandular.

H. Vertical section of upper part of a cotyledonary petiole; epidermis changing into thin-walled hairs.

M. Transverse section near the apex of a growing stem; *lt* filiform, and *st* capitate trichome.

New Plants of New Mexico and Arizona.—TALINUM HUMILE.—Acaulescent, glabrous and very succulent; root with an oblong orange-colored tuber an inch long; leaves terete, 2–3 inches long, lying flat upon the ground; the dichotomously branched scapes only half as long as the leaves. 5–10 flowered; sepals pointed; petals light yellow, changing to orange in drying; seeds black, marked with circular lines.

On a rocky table land near the southern base of the Pinos Altos Mountains, New Mexico, Aug. 11, 1880. The plant is probably rare, as only some eighteen specimens could be found. The flowers at 2 o'clock p. m. had not yet opened, hence it is one of those species whose flowers open at evening and close in the morning. In habit it is much like *Calandrinia pygmæa*; it has the color and the seeds nearly of *T. aurantiacum*, but is most distinct from that species, by its habit, and its succulent herbage.

LINUM NEO-MEXICANUM.—Annual or biennial, glabrous and glaucescent; stems 1–2½ feet high, branched from the base, the branches very strictly erect and narrowly paniculate for more than half their length; lowest leaves opposite, and when viewed from above showing a cruciate arrangement, the upper alternate, all lanceolate, or oblong, acute, sessile, entire; pedicels 3–6 lines long, with marginal angles; sepals broadly lanceolate, scarcely equalling the capsules, the margins sparingly glandular denticulate; corolla a half inch in diameter, light yellow; styles free to the base; capsule incompletely 10 celled.

In woods of *Pinus ponderosa* on the Pinos Altos Mountains, New Mexico, August and September, 1880. A tall, graceful species, with sometimes almost racemose inflorescence.

BIGELOVIA (APLODISCUS) RUPESTRIS.—Less than a foot high, much branched from the base, woody and brittle; flowering branch

lets short and very leafy ; leaves a half inch long, obovate-lanceolate, entire, ending with an abrupt sharp point, veinless, coriaceous, very punctate on both sides with rather coarse, dark, resinous dots; bark of the green, leafy branchlets minutely warty, and the branches of the dense corymb clothed with small, triangular scales ; heads a half inch long, about 12 flowered ; the innermost scales of the turbinate involucre linear lanceolate, the outer gradually shorter, all rather acute, with minutely barbellate, scarious margins ; style appendages subulate about equaling the stigmatic portion ; the short, subturbinate akenes silky villous.

Growing in dense hemispherical tufts from crevices of perpendicular cliffs which crown the highest San Francisco Mountains in Arizona. In flower Nov. 1, 1880.

From the description of *Bigelovia spathulata* of Lower Calif rnia this new shrub of Arizona must be its nearest ally.

Bigelovia (Chrysothamnus) juncea.—Shrubby. much branched, cinereous; branches closely fastigiate, very slender and straight, fastigiate-corymbose at summit; leaves very few, linear-filiform, or none; involucres five-flowered; scales very strictly five-ranked, the outermost short ovate, the inner linear-lanceolate, all obtuse at apex; akenes slender, five-angled, minutely but rather densely pubescent; pappus of slender, scabrous, unequal bristles.

Calcareous bluffs of the Gila River in eastern Arizona very near the New Mexican boundary, in flower Sept. 5, 1880.

A very compact shrub, at time of flowering wholly leafless and reedy looking. It is very closely allied to *B. Bigelovii*, Gray, of Northern New Mexico, but of quite different aspect, with its much more slender, more numerous, and greener branches; while the pubescent akenes mark it as clearly distinct.

Hieracium carneum.—Stem 2 feet high, simple, leafy up to the base of the ample, loose corymbose panicle, glabrous; radical leaves from ovate to oblong lanceolate densely clothed with long, coarse, somewhat appressed white hairs, the cauline lanceolate and all except the very lowest, smooth and glaucescent, all sessile; peduncles an inch long, minutely bracteolate; the scarcely calyculate involucre glabrous; achenia columnar, very slightly attenuated at summit; pappus bright white; flowers deep flesh color.

South base of the Pinos Altos Mountains, New Mexico, in woods of *Quercus hypoleuca* and *Q. Emoryi*, flowering in October, 1880. A remarkable species of its genus both on account of its flesh-purple flowers, and the strong contrast between the radical and the cauline leaves, the former being white with long wooly hairs, the latter perfectly smooth and a little glaucous It is perhaps most nearly related to *H. albiflorum* which ranges farther north and west.

Euphorbia (Anisophyllum) versicolor.—Annual, prostrate, the red stems pubescent with soft, spreading hairs; leaves less hairy, round ovate to oblong, 3 lines long, rounded above, slightly cuneate at base, on petioles a line or more in length ; stipules none ; involucres solitary in the axils and at the ends of the branchlets; glands erect, purple, their appendages cuneate-obovate, to nearly quadrangular,

white changing to deep rose-red; styles bifid to below the middle; capsules pubescent, angled; seeds light ash colored, short oblong, acutely 4 angled, transversely rugose.

Canons of the San Francisco Mountains, Arizona, September 1880.

Very closely related to *E. setiloba*, Engelm, but a larger plant, (forming mats often more than 2 feet across) less leafy, (the internodes an inch long) and less closely appressed to the earth; the seeds also are of a different color, those of *E. setiloba* being more of a reddish gray; but the most obvious distinction is in the appendages of the glands, which, in the species last named, are divided into three setiform lobes; whereas in *E. versicolor* they are nearly always entire, rarely retuse or erose. These appendages in both species undergo a change of color; but that change is most marked in the new one.

TRADESCANTIA TUBEROSA.—Stems solitary from a horizontal, jointed, tuberiferous rhizome, 6 to 12 inches high, simple, slender, retroversely puberulent; leaves narrowly linear, rather fleshy, not open; sheaths ciliate; umbels terminal few or many flowered; pedicels and sepals glandular hairy; corolla purple.

Pinos Altos Mountains, New Mexico, in flower August 23, 1880.

The plant would readily pass for a form of *T. Virginica*, which is also common in the same region, but for its entirely different root and habit of growth. The yellow tubers, borne singly or by twos and threes, at the joints of the rhizome, are oblong, an inch or more in length, and obtuse at both ends. My correspondents have received specimens of this plant under another name, which I hereby beg them to erase; substituting the one here given.—EDWARD LEE GREENE.

The British Moss-Flora, By *R. Braithwaite*, M. D., F. L. S. &c.—So large a proportion of the North American Mosses are identical with those of Great Britain that the present work may well be commended to American botanists. It is issued in parts, as was Schimper's *Bryologia Europæa*, and it apparently yields in no respect to that great work in the character and completeness both of the letter press and the plates. But it promises to be of moderate extent, the price is certainly moderate, and the text is entirely in English. The mosses are taken up monographically, family by family in a natural arrangement, this arrangement being essentially that recently proposed by Lindberg. Parts 1 and 2 have only two plates each; but the third, a monograph of the *Polytrichaceæ*, has four, which illustrate fifteen species. It is intended to go on with four plates to each fasciculus, and to charge at the rate of a shilling a plate, including all letter press, and this runs at the rate of a page or two to each species. At this price remitted to the author, at 303 Clapham Road, the work will be sent post paid to subscribers in the United States. Publishers do not like to meddle with works like this, of limited sale and occasional issue in detached parts, so the author, to whom this is a labor of love, acts as his own publisher, and is glad to receive subscriptions directly. Certainly he spares neither pains nor expense. The work is as beautiful as it is excellent and thorough. It is in imperial octavo, descrip-

tions, references and synonymy full; the drawings, all by the author's own hand, may challenge comparison with those of Sullivant, and the lithography does them justice. This moss-flora is appropriately dedicated: "To the memory of the late William Wilson, the greatest of British Bryologists."—A. GRAY.

Botanical Charts.—For the benefit of any readers of the GAZETTE who are teachers of Botany I wish to give a brief description of a method of preparing botanical charts which may be of great service in illustration of the subject. While recognizing the fact that the only proper way to teach the science is by actual dissection and demonstration under the microscope I also know the fact that many have to teach botany in the best way they can without microscopes. Even to those whose departments are well supplied these charts may be helpful in illustrating a course of lectures, in the class room or to popular audiences I have never seen anything similar in use and believe that they are here first described.

Prof. L. S. Thompson in charge of the Department of Industrial Art of Purdue University after considerable experimenting to find a cheap, easily made and convenient chart for use in his class-room has determined upon this form as being in every way the best. Seeing them there I have constructed a number for use in botanical instruction. By his permission I here describe them hoping they may be of use in the sciences as well as in art.

Sheets of strong smooth manilla paper (the quality used for genus covers is the best but a little more expensive than necessary) 40×48 inches are to be had at any book store or paper house. These cut along the fold make a convenient size 24×40 or if larger is wanted a sheet 36×48 left uncut is most suitable. On these the illustrations to be used may first be sketched in pencil and then completed in India ink. Crayon may be used and if it shows any tendency to blur (as it usually does when handled) may be sprayed with a solution of shellac in alcohol by means of an atomizer. As this is troublesome India ink is preferable. Very frequently students with time and talent enough can either do the whole of the work or the preliminary sketching. Experience will dictate the best illustrations, such as Figs. 123, 219, 224 and 565 in Gray's Structural Botany; 18 a, 26 and 77 from Sachs and 53 73 and 302 from Bessey are easily put on and serve a good turn in demonstration.

Having completed a sufficient number of charts procure the round pine sticks used for curtain rollers, a shoemaker's eyelet punch and fastener, a few eyelets and a few small screws. Along the top edge of a series of charts (twenty five is a convenient number) punch four or five holes, insert and fasten the eyelets and you have them securely bound together. It is well, to prevent the tearing off of the outer chart, to fasten in the holes small bits of tin thus giving greater bearing surface to the rim of the eyelet. Now with the small screws fasten the bunch to the roller and the work is done.

For supporting these charts a light frame tripod with a cross piece at the top furnished with hooks at suitable distances to catch into corres-

ponding "eyes" on the roller is used. As the under charts are wanted the upper ones can be thrown over the top and out of the way.

A word in regard to the preparation of the India ink. If you follow the ordinary directions, viz: to rub down the quantity needed in a porcelain dish, after grinding away till your arms ache, you will have enough perhaps to outline one illustration and probably half of that will evaporate before you are ready to use it. Instead, take about half a stick break it into pieces the size of a grain of wheat and allow it to soak over night in just enough water to cover it. When you are ready to use dilute until it will just leave a perfectly black mark. If at all lumpy rub to a smooth paste with a flat ended stick. Apply with a camel's hair or sable brush—one tapering to a fine point will be found easiest to handle. Let me assure any who care to attempt the manufacture that it takes very little artistic talent, very little time and very little trouble to produce results that will astonish the maker. (No sarcasm) These charts are cheap, portable and efficient; qualities possessed by none of the more elaborate ones of the publishers. I shall be glad to give any further details of construction if any one so desires.—C. R. BARNES, *Purdue Univ., LaFayette, Ind.*

The Flora of Essex County, Massachusetts, John Robinson, Essex Institute, Salem, 1880.—An elegant Catalogue of 200 pages. Those who are familiar with Prof. Robinson's methods will not need to be told that this Catalogue is a most thorough and admirable work. No finer Catalogue has been published since Paine's model catalogue of the plants of Oneida County, N. Y., and could the lamented Oakes, to whose memory it is so gracefully dedicated, have lived to see this tribute to the flora of a region "where he was born, and where he loved to botanize," his pleasure would have been very great indeed

Tracy's modest "Studies of the Essex Flora" was only partial in its character, being limited to the vicinity of Lynn, and containing only the flowering plants of that region; but the present Catalogue covers the entire County, and contains the lower, as well as the higher orders of plants.

Combining within her limits sea shore and wood land of varied character, Essex County offers rare attractions to a botanist, and how well sea-shore and wood land, meadow and hill have been gleaned for treasures this splendid record attests. 1694 species and 140 varieties are enumerated representing 115 orders.

The remarkable resemblance between the wood lands of Essex and those of New Hampshire has often been noticed by visiting botanists, and it is not surprising to find recorded here many plants common to both regions.

The writer has passed many pleasant hours in the Essex woods with the author, the recollection of which he will long cherish, and it gives him much pleasure now to bear witness to the zeal and fidelity with which the author has devoted himself to this work of the "Essex Flora," the completeness with which it has been consummated, and the very elegant form in which it is presented.

Full credit is given to all who have aided the author in any way,

and the names of Gray, Watson, Goodale, Farlow, Austin, Halstead, Faxon and Collins ensure accuracy of determination.

The Catalogue will serve to stimulate the botanical section of the Middlesex Institute which has in contemplation the publication at an early day of a complete Catalogue of the Middlesex Flora.—G. E. D.

Notes from Arkansas.—Hearing of some very large trees of Chinquapin in Arkansas, that were reported as 15 and 18 inches in diameter, I went to see them on the Washita river.

The tree is not uncommon about Hot Springs, Ark., near the base of the mountains many were seen that appeared to be 12 or more inches through and one that was carefully measured gave a circumference of six feet plump, which is equal to two feet diameter at stump high. I was informed that they were used in some places for rail timber, but all that I saw were low-headed and could furnish but one cut for such purpose.

When conversing with Dr. Engelman respecting these trees he reminded me of a mistake made by a distinguished botanist, who having heard of these trees, and possibly seen them in the winter mistook them for *Castanea vesca*. It is still believed that our chestnut is not found west of the Mississippi.

In the same region *Magnolia tripetala* was seen of large size, reaching a diameter of eight inches.

About Hot Springs the pines were all *P. mitis*, and the line of the St Louis, Iron Mt. and Southern Railway about Malvern Station seemed to be the meeting place of *P mitis* and *P. australis*, upon the borders of the metamorphic rocks and the Cretaceous and Tertiary formations. Near this latter place the *Magnolia grandiflora* and *Ilex opaca* are found. Near Hot Springs seven oaks were seen; *Q. alba*, *Q. Muhlenbergii*, *Q. nigra*, *Q. falcata*, *Q. tinctoria*, *Q. rubra*, *Q. obtusiloba*. *Q. imbricaria*, at Iron Mt., Mo., had leaves 8⅝ inches long including the short petiole, by 5¾ inches wide.—Jno. A. Warder, *North Bend, Ohio.*

Rudbeckia rupestris, n. sp.—Stem (3°–5°) and leaves sparingly hairy, branches elongated and terminated by single large heads; upper leaves ovate lanceolate, coarsely serrate, sessile, partly clasping, the lower 3 parted, with deep rounded sinuses, the lower lobes standing out almost halberd shaped, with margined petioles, the lowest 4′ in length and breadth, on long petioles (3′), radical leaves undivided, rhomboid-oval; disk large (¾′), globular, black purple; rays 10–13, 1′–1½′ long, linear-oblong, uniform orange yellow; involucral scales few, spreading, long lanceolate, hirsute, leaf like; chaff of the disk toothed tapering into a slender awn.

Differs from *R. triloba* in the thicker, larger and more halberd shaped leaves, in the fewer (3-5) but much larger heads, and longer rays with no change of color near the disk; and from *R. subtomentosa*, in its smoother, thicker, and broader leaves, in the color of the rays, and in the awned chaff of the disk.

Found abundantly on the rocky slopes of "Little Roan," N. C.,

at an altitude of 5500 feet, in company with *Liatris spicata*, *Melanthium Virginicum*, and *Delphinium exaltatum*.—J. W. CHICKERING, *Washington, D. C.*

Ferns of Arkansas.—An exhaustive list of the ferns of Arkansas having never been published, but little is known by fern specialists of the representatives of this order in this State. Having been urged by several correspondents to prepare a list, we take great pleasure in presenting our observations, up to date, to the GAZETTE for publication, that they may reach a greater number of botanists.

The varied physical features of Arkansas give a wide range of habitat.

Upon the dry calcareous cliffs of the mountainous region, with a south exposure, are found the conditions favorable for the growth of such genera as *Chcilanthes*, *Notholoena* and *Pellæa*.

The mountain gorges of N. W. Arkansas, shaded from the direct rays of the sun are favorite places for shade and moisture loving genera, such as *Polypodium*, *Asplenium*, *Adiantum*, *Camptosorus*, *Cystopteris*, *Woodsia* and some species of *Aspidium*

In open woods, in dry calcareous soil, *Phegopteris* and *Pteris* are found.

The low rich woods and swamps invite *Osmunda*, *Botrychium*, *Ophioglossum*, *Woodwardia*, *Onoclea*, and some species of *Aspidium* and *Asplenium*.

We are able to report *forty* forms (including varieties) as the present number of ferns known in Arkansas. An exhaustive list is not claimed, as each year's research has been rewarded by one or two species, and probably more will be found.

The order is well represented in this State by seven of the ten tribes of *Polypodiaceæ* and a range of twelve genera, besides *Osmundaceæ* and the two American genera of *Ophioglossaceæ*.

The following list is arranged in accordance with the excellent "Fern List" by Prof. D. C. Eaton recently published.

ORDER FILICES.

SUBORDER POLYPODIACEÆ.

TRIBE ACROSTICHEÆ.

(Not Represented.)

TRIBE POLYPODIEÆ.

1. *Polypodium vulgare*, L.—N. W. Arkansas, upon rocks in shaded damp situations Grows large and thrifty. Seems to prefer sandstone, though it grows on moss covered trees near shaded cliffs. Never found on limestone in this region.

2. *Polypodium incanum*, Swartz.—Found sparingly, in depauperate form, in N. W. Ark., upon the escarpments of sandstone cliffs near permanent moisture. S. Ark. upon moss covered trees abundantly. The specimens are large and well developed. Grows luxuriantly upon the shaded sides of low trees with horizontal branches.

TRIBE GRAMMITIDEÆ.

3 *Notholoena dealbata*, Kunze.—N. W. Ark., abundantly, upon the

escarpments of limestone cliffs with a south exposure. It seems to prefer isolated masses of limestone, separated from the main cliff by land slides.

TRIBE VITTARIEÆ.

(Not Represented.)

TRIBE PTERIDEÆ.

4. *Cheilanthes Alabamensis*, Kunze.—Distributed throughout the mountainous region of Arkansas upon limestone ledges only. Usually in comparatively dry situations, though found in shaded places and niches of rocks where it grows larger. This species flourishes upon the tufa ledges, deposited by the Hot Springs in Garland Co. in very moist places. Inland and along streams.

5. *Cheilanthes vestita*, Swartz.—Throughout the N. and W. part of the State upon the flat tops of sandstone ledges, generally, but sparingly in similar situations upon limestone. Plentiful inland and also upon the river cliffs.

6. *Cheilanthes lanuginosa*, Nutt.—Grows quite plentifully, in only one known situation, in N. W. Ark. It is found on limestone cliffs, upon the N. and E. sides of valleys running inland from White River. Though loving the light, it grows larger when protected by projections. Its habitat is similar to that of *Notholæna dealbata*, though they have never been found together. The species may be regarded as scarce in Arkansas.

7. *Cheilanthes tomentosa*, Link.—Sparingly in N. W. Ark. upon limestone cliffs. Plentiful in the mountains of the S. W. part of the State. It grows in dry situations upon sandstone, shale and limestone. It is most abundant high up the hills near the base of ledges facing the south, but can be found on limestone cliffs sparingly, or in moist valleys upon all formations.

8. *Pellæa atropurpurea*, Fee.—Plentiful throughout the upland portion of the State, upon the escarpments of sandstone and limestone ledges with a south exposure. Grows inland upon the cliffs of eroded valleys, as well as along streams.

9. *Pteris aquilina*, L.—Occurs in the N. W. part of Ark. upon hills and prairies, but the most common form is:

var. *caudata*, Hooker, which is found all over the S. part of the State on the ridges and is known as "Upland Fern."

10. *Adiantum Capillus-Veneris*, L.—Throughout the N. and W. part of Ark., upon both lime and sandstone cliffs, in situations affording perennial moisture.

The finest specimens found in the U. S. (of this species) grow in N. W. Ark. upon shelving sandstone ledges of White River, between high and low water mark. It grows on the calcareous tufa ledges at Hot Springs Nothing in the foliage of plants could excite more admiration than a crevice for several hundred feet adorned by an uninterrupted line of these graceful drooping ferns.

11. *Adiantum pedatum*, L.—Throughout N. and W. Ark. in the upland country. It grows most luxuriantly at the base of shelving sandstone cliffs in shaded and damp situations, but is also found along shaded moist ravines in rich woods.

Prenanthes (Nabalus) Roanensis, Chickering.—In view of the fact that Bentham and Hooker have merged the genus Nabalus in the older Prenanthes, which revision will undoubtedly stand, I would change the name of *Nabalus Roanensis*, n. sp., described in BOTANICAL GAZETTE for December 1880, to that given above.—J. W. CHICKERING.

Recent Periodicals.—*Trimen's Journal of Botany* for January contains the following original articles: On *Chara obtusa*, Desv., a species new to Britain, by Henry and James Groves, accompanied by plate 216; The History of the Scorpioid Cyme, by Sydney H. Vines; on *Potamogeton lanceolatus* of Smith by C. C. Babington; Musci Præteriti, (continued) by Richard Spruce; on the Plants of (North) Aran Island, Co. Donegal, by Henry Chichester Hart.

Nature in its four numbers for January gives the following papers to the botanical public: A chapter in the History of the Coniferæ, II, by J. Starkie Gardner, in which is considered the Ginkgo or *Salisburia*: Dr. Maxwell Masters on Dimorphic Leaves of Conifers.

Hardwicke's Science Gossip for January and February contains "Botanical notes from the Swiss Highlands;" "Notes on some of our smaller fungi," illustrated; "Science-Gossip Botanical Exchange Club Report for 1880;" "Notes on Terminal and Subterminal Buds."

American Naturalist for February contains a paper by Lester F. Ward, entitled "Incomplete Adaptation as illustrated by the History of Sex in Plants." In the department devoted to Botany we note "The Fungi which produce Mildew on Cotton Goods." The editor has in preparation a sketch of the Progress of Botany in the United States in the year 1880 and is anxious to procure copies of papers and other publications made during the year

Bulletin of the Torrey Botanical Club for February contains "The Fertilization of Alpine Flowers," by William Trelease; "Preservation of Pileate Fungi for the Herbarium," by W. R. Gerard; "Lists of Local and State Floras" (Middle States).

A List of Plants in Malden and Medford, Mass., etc.—This little catalogue of 20 pages is published by the Middlesex Institute and with alternate blank leaves, is intended to be used as a check list and note book for local collectors.

An Essay on Timber Planting in Ohio, by Dr. Jno. A. Warder. This deserves a fuller notice than our crowded pages will at present allow, but we will make use of it hereafter.

Flora of Indiana.—With this number we issue a small outline map of Indiana to accompany the Catalogue. Upon it will be found the County names and by its help the distribution as indicated in the Catalogue can be clearly seen It should be preserved and bound up with the Catalogue when completed.

COLUMBIA COL
HERBARIUM
NEW YORK

Botanical Gazette.

Vol. VI. APRIL, 1881. No. 4.

Editorial.—With this issue we publish the first of several papers by Dr. J. T. Rothrock upon the Modes of Work in de Bary's Laboratory at Strassburg That they will be read with interest by our workers in Anatomy and Physiology is but natural; for they will be a description of one of the most famous laboratories in the world, by one of our most skillful investigators.

Dr. Asa Gray, in a private letter from Kew Gardens, assures us that he is not resting from labor, but is busier than ever. With the change of a word, he uses the old quotation, *cœlum non laborem mutant qui trans mare currunt.*

Contributors must exercise some patience in waiting for the appearance of their articles. The Gazette is getting to be quite popular and no contributor can now be certain of an immediate place in our pages. If, then, two or three months pass without a sign from us no alarm need be felt, for everything will be worked in in its own time, and the appearance will condone for much delay. This is not meant to stop the flow of contributions, for we would like it to be steadier and stronger than it is now, but as a word of explanation to many of our friends who may by this time have lost all patience with us.

Mr. H. H. Rusby's article on the Ferns of New Mexico has been sent to us through the kindness of the Syracuse Botanical Club, Mrs. F. J. Myers, Secretary. This organization of ladies is unwearying in study and exploration.

Mr. Lucien M. Underwood, of Bloomington, Ill., has published a neat check list of North American Pteridophyta, excluding the Orders *Filices* and *Ophioglossaceæ*. Order *Equisetaceæ* contains 13 species; *Lycopodiaceæ* 12; *Selaginellaceæ* 6; *Isoetaceæ* 14; *Marsiliaceæ* (three genera) 7. The author states that the list is merely preliminary and that he will be glad to receive specimens and notes, that a full account of native Pteridophyta may be prepared.

Prof. Marcus E. Jones, of Salt Lake City, Utah, has published his list of Utah plants. Prof. Jones is an indefatigable collector and his plants are very desirable. The coming season he will botanize through Utah, Nevada, California and Arizona.

Prof. W. G. Farlow has just published a paper, with plates, upon the Gymnosporangia or Cedar-Apples of the U. S. An early review of it may be expected in the Gazette.

In the last part of the second volume of *Beitrage zur Biologie der Pflanzen* are some important papers on fungi and Bacteria, and one on physiology. Dr. Just has been experimenting on the action of high temperatures on the preservation and germination of seeds. He finds that perfectly dry seeds can withstand a temperature of even 120°

and 125° Cent. without injury. Dr. Koch gives directions for the preparation of specimens of bacteria.

MR. G. BENTHAM has presented the Linnean Society a contribution containing the results of his study of the *Orchideæ*. He groups them into five tribes and twenty-seven sub-tribes.

FRANCIS DARWIN, in a recent number of *Nature* gives a review of Dr. Hermann Muller's work on Alpine Flowers. Of course the relation of Alpine Flowers to insects is the burden of the book, which must be an extremely interesting one. One of the most striking facts is that in Alpine regions butterflies predominate, largely replacing the Hymenoptera of the lowlands. With this change of guests must come a change in structure, for a corolla that will admit a bee, will by no means necessarily be fertilized by the proboscis of a Lepidopterous insect. Thus, members of the same genus will have open mouthed corollas in the lowlands, and contracted throats in the Alpine regions, may be with no opening but the minute "butterfly-door." The relation existing between the colors of flowers and insect visits is also considered and is by no means the least readable part of the book.

Notes on Modes of Work in the Laboratory of Prof. de Bary in Strassburg, Germany. I.—There are two reasons why some statements under the above heading might be of service in our country: first, because of the simplicity of the appliances used in one of the most productive botanical laboratories abroad, and second, because the modes of investigation, though not entirely unknown or untaught here, merit a wider diffusion.

Taking up the first of these reasons, we may say that microscopy, simple and pure, has done good work here in getting us instruments of great efficiency at lower rates than formerly, but has proved so attractive that it has lured to itself absolutely many who might well bestow a portion of their time on real biological investigation. Indeed, it has even gone further and, by some means, induced a feeling, on the part of those contemplating the purchase of a microscope, that they will wait until they can obtain one of the highest grade. This reminds one of a physician resolving to go on foot until he can drive two horses, ignoring the fact that one might render him essential service, to start with, at least. There is ordinarily no objection to the most costly instrument (save its size,) and it is, beside, supposed to be fitted for all manner of work; but on the other hand, it is to be remembered that nearly all (not to say all) the best botanical work has been done in Europe with extremely cheap microscopes, i. e., a mere stand with good eye-pieces and good objectives. And I may also add that Robert Brown's work was done in part, if not entirely, with a simple microscope, and that the recent solid contribution to American biological literature. *Leidy's Rhizopods*, was made with the little Hartnach, and the Beck Economic Microscopes. So then I make this statement at the outset, that for fifty dollars one may purchase an American Microscope which will do as good work as those found in European Laboratories. On my table lies a cut of a Zentmeyer instrument, named by him the American Student Stand, with 1 Eye-

piece (A or B); 8-10 objective, 24°; 1-5 objective, 75°; and Walnut Case, which, with Lock and Handle, is sold at $38. There are other instruments at as low, or nearly as low prices, which are also capable of doing as good original work. Now then I will make the direct statement. If you contemplate purchasing a microscope, do not delay until you can purchase the most complicated. You will be astonished when you come to discover the real capacity of such as I have indicated.

The instruments most in use in the laboratory of Prof. de Bary are those of Hartnach, small, compact, without sub-stage or without joint to turn the tube back. The optical parts are of course good and give a magnifying power of about six hundred diameters.

MEANS OF MAKING SECTIONS. Razors alone are used. These may or may not be flat on one side. The knife which we have here specially made for the purpose is not requisite, and therefore an unnecessary cost. Neither do we find *in use* the expensive section holders, which figure so conspicuously on the tables of our amateurs. As a means of holding a small soft specimen, pith taken from any plant which furnishes it more than half an inch in diameter is sufficient, and is much better than cork, which is often used in the English laboratories, as the latter often contains grit enough to dull the razors. The cylinder of pith is simply cut down the middle and in pieces sufficiently long to be comfortably held by the thumb and finger, and the object is placed between. Or, for very small, precious objects, a few drops of stearine are allowed to fall from a candle on a glass slide, then, when cool, the object placed upon it, and a few drops more placed on top and the whole allowed to harden, then by *slightly* warming the slide, the mass may be removed and held as in the case of the pith. The adhering stearine has the advantage of being readily removed by alcohol from the section. As for the object, it is safe to assert that the custom is to make it as thin as possible, and always much thinner than we are accustomed to make it here. As a rule, the mounting medium is glycerine, and no attempt is made at staining or double staining. To make a permanent mounting of a desirable preparation, the Asphalt cement of Neumann & Son, Berlin, 51 Tauben Strasse, is used, and to prevent this from being loosened by the contraction of the cement as it hardens, a very fine thread of glass is placed under one side of the cover glass. After considerable trial I am very well satisfied a much better mode is to either make a thin ring of a strong solution of gum shellac in alcohol and allow it to harden and then mount as before, or to make the first coat, at least, of this and then place a subsequent coat of Asphaltum over this when it has hardened. I am bound to say that I have used no American cement that I did not like as well as that of Neumann, though, from the fact of its being in use in all the laboratories of Europe, it must have decided merit. It hardens very quickly. For durability, however, one cannot well forget the decided statement of Dr. Carpenter, that, after thirty years experience and trial of gold size, he had come to prefer it.

For the softer, thinner tissues there can be no doubt but the Euro-

pean glycerine mount is better than that in Canada balsam, which we more commonly use. There is a greater sharpness of outline given to the object. Among the instruments we miss from the German Laboratories is the polarizer as a common microscopic adjunct. For the study of starch and for tracing the laticiferous vessels in many cases, it is of the most essential service. The Jackson eye piece micrometer gives way to the simple round disk in the eye-piece and for all practical purposes is quite as good and much less expensive. It is fair to say that, among lower plants, the same reliance we place upon *exact* spore measurements is not found; the evidence based upon them being considered as confirmatory rather than conclusive; and probably with good reason. During the short winter days a large portion of the work done is by the aid of well shaded gas light, the intensity of which is more or less modified by colored chimneys; the flame being round and steady from the Argand burner. All theory aside, I cannot see but that it was as good as that from the coal oil which we insist upon as being essential.—J. T. ROTHROCK.

Some New Mexican Ferns. I.—In order that we should gain a correct knowledge of the flora of any section, some knowledge of its soil and climate is essential; a proposition which would seem to apply specially to the ferns.

The whole of New Mexico is a table-land, with superimposed mountains. The country along the rivers is usually very sandy, as are some of the plains between the mountain ridges. Others of these plains are gravelly, while others consist of a fine, deep soil, which, however, is always mixed, more or less, with gravel. So far as my observation goes, no ferns whatever grow in any of these localities. They are to be found only in the mountains. I have not found one fern growing on level ground, or in sandy or alluvial soil. Under these circumstances, we should expect to find the general character of the ferns very different from that of our eastern species. The difference is allowed to become still greater by the great difference in climate. Here, when it rains, it does little else, and when it dries, everything dries, and keeps on drying until it begins to rain again. Not having been here in the spring, I have been unable to gain any exact information as to the extent to which the ferns develop at that season. The most that I have been able to learn is that when there is an abundance of rain or snow during the winter and spring, the ferns spring up. Certain it is, that before the beginning of the rainy season in July, they are all as dry, and apparently dead, as though there had been no period of spring growth. Within a month after the beginning of the rains, they have made a good start, and within another month, the most of them have shown considerable fruit. A few, however, do not mature their spores until late in the fall, appearing to banter Old Winter with the challenge, "Catch me if you can!" These conditions combine to strip the ferns of that freshness and delicacy, or, I may say, that *crisp fragility*, which characterize our eastern species. Those which are not hairy or scaly are thickish and glaucous. The only eastern species that I can now recall as likely to give one an idea of the *tout ensemble* of these species is *Cheilanthes vestita*, Swz., or, to a

slight extent, *Aspidium aculeatum*, Swz , var. *Braunii*. The only one that I have found here to remind me in any way of those at home is a new variety of *Woodsia Oregana*, D. C. Eaton. These species are also peculiar in their dwarf habit. The majority of them never reach a height of one foot, while the extreme height of the two largest species is about two feet.

The whole number of species which I have found here is fourteen, all having been collected in Grant county. Beginning with *Cheilanthes*, I find six species, one of them, *referring to the segments*, smooth, two scaly, one hairy, and two both scaly and hairy. The smooth species is *C. Wrightii*, Hooker, which I have found in very small quantity, in a single locality, in two dense patches. This is on the sloping side of a very high mountain (a little over 7,000 feet), exposed to the very brightest sunshine, and rooting in partially decomposed, shelly sandstone. It is the smallest of my ferns, being but three or four inches in height, and very pretty. It is thickish, and almost coriaceous. The most beautiful portion of this fern is it stalk, which is of a very rare color, — a sort of a deep, shining bronze-brown. A dense cluster of these stalks looks brilliant in the sunshine. The lower part of the stalk is chaffy. This fern fruits during the middle of the season, that is during October.

Cheilanthes lanuginosa, Nutt., growing in the Northern Central States, is probably well known to most of you. It is very pretty here, growing in dense, though small tufts, in little hollows and crevices of perpendicular rocks, where there seems to be no soil whatever, and always on the north side, where no sun can ever reach it. It is one of the earliest ferns to fruit.

Cheilanthes Eatoni, Baker, the commonest and most abundant species, is one of the most beautiful. The largest specimens reach a height of a foot, and the fronds are so abundantly clothed with tomentum as to present a silvery white appearance. The mid rib only is scaly, so that when held to the light there is nothing to obscure the view of the minute and delicate segments, surrounded with their circles of silvery hairs Happy Mr. Eaton, to have his name associated with so beautiful a fern, and happy fern to be so connected with such a botanist! It grows everywhere among rocks, flourishing best in moderate shade.

Cheilanthes Fendleri, Hooker, is the scaly species. When first found, my companion named it "The Hard Green Fern," from the compact and bright-green appearance of the fronds. It grows in large but not dense patches, on hillsides, in gravel and in moderately shady situations. So slight is its articulation that is difficult to remove the dirt from specimens without knocking off all the fronds The color of the scales is said to be "white, changing to brown." I would add that when mature they again fade to a white ; but it is a grayish-white, easily distinguished from the almost pure white of those on young fronds. It fruits in November being one of the latest species.

Two interesting species I find which I think are *C. myriophylla*, Desvaux, and *C. Lindheimeri*, Hooker. The former I have found within a day or two, but in such an aged state that even the determination is doubtful. I do not know its time of fruiting.

C. Lindheimeri presents a very striking appearance, which is not easily mistaken or forgotten. It is best described by my companion's homely name of "The Flat White Fern." The upper surface is very white, very flat, and very compact as to the arrangement of the segments. The under surface is at first whitish, changing to a rusty brown, and later, to a silver gray. Its habit of growth is as peculiar as its appearance. It flourishes in shade or in sunshine, but best in moderate sunshine, and does not grow at all in constant shade. Wherever a mass of great jagged rocks is observed, there this fern may be looked for with an almost certainty of finding it. It always grows in the dirt which has lodged in the crevices of rocks, and these crevices it completely fills, so that a hook being inserted in the upper end of the crevice, a rope or strip of ferns, sometimes yards in length, may be torn up. As it is very late in fruiting, many fronds being without fruit as late as December, it has occurred to me that it selects these situations for the sake of the heat afforded during the night by the adjacent rocks. This may be called "The Sensitive *Cheilanthes*", as the pinnæ curl almost as soon as the plant is removed from the soil. Having removed even as few as ten specimens, it is difficult to press them in time to save them all.

Three *Pellæas* have been found, the first being our old friend, *P. atropurpurea*, Link, which grows near the bottoms of canons, in very shady positions, and which reaches its greatest perfection late in the fall, after the cold weather has begun. At this season I have found specimens more than twenty inches in height, and really stately in their beauty. It always selects a deep, rich soil. It fruits moderately early.

Pellæa Wrightiana, Hooker, is very different from the former species, very striking in its appearance, and very beautiful. I have found only a few exceeding ten inches in height. Half of this length is occupied by the dark brown, almost black stalk, which contrasts beautifully with the vivid bluish green, smooth fronds. The thick segments, before becoming recurved in fruit, are roundish, of the size of the head of a large tack, and tipped with a whitish, subulate point. They are arranged with great regularity. As the plant grows in the densest tufts, these segments are always hooked together in so intricate a manner that it is quite a task to separate them, and the fronds being very brittle, this is one of the most difficult ferns to collect in good specimens. It is always found on rocky hillsides, under the edges or in the crevices of rocks where there is but little earth, and where it can enjoy bright sunshine for a part of the day. It fruits during October.

Pellæa andromedæfolia, Fee, var. *pubescens*, is the only species except a *Notholæna*, which attains a height of two feet. The *Notholæna*, being very narrow, leaves this *Pellæa* the largest fern of this section. It is very scarce, being found in only a few localities, and there sparingly, so that I have been unable to secure enough specimens to supply all my sets. Notwithstanding its large size, it is very light and graceful in appearance, the segments being quite widely separated. These are roundish oblong, about one half an inch in length, of a light

glaucous green above, and a reddish glaucous green below. The stalks are reddish. It is invariably found in the deepest shade of underbrush, and usually growing up through dead brush. As it is exceedingly brittle, a strong puff of wind being sufficient to break off the tips when entangled, this habit of growing in brush makes it exceedingly difficult to secure entire specimens. I have been unable to secure more than one frond out of three in a presentable condition. It fruits during the middle of October, the fruit forming a deep black margin to the lightish colored segments.—HENRY H. RUSBY.

On the Colors of some Western Flowers.—There are a good many mistakes about them in the books *Cordylanthus Wrightii*, Gray, for example, is everywhere described as having a purplish corolla, whereas it is of a fine, light-sulphur yellow, which stands in showy contrast with the commonly rich, dark purple calyx which half encloses it.

Orthocarpus purpureo albus, Gray, is said to have corollas "purple and often partly white;" the truth being that they are always clear white on opening, and that after the first day they change to rose-purple.

In the January GAZETTE under *Ribes pinetorum*, Greene, I said that the flowers of *R. leptanthum*, Gray, are "white, not yellow, as said by Mr. Watson in Bot. King." But Mr. Watson writes to me that he has seen acres of it with yellow flowers. Now though the species occurs plentifully west of the Rocky Mountains I do not happen to have met with it but in Colorado and New Mexico, the locality whence it was first obtained, and I have never seen it but with white flowers, though there is usually a tip, or marking of decided green. The dubious var. *brachyanthum*, Gray, of California shows a tinge of purple. Will not our botanists in different parts of our western field take notice. the coming season, and all tell us through the GAZETTE what they find to be the color of flowers in *R. leptanthum?* Of course they may vary in different localities, but if this be the case, it should be established clearly.—EDWARD LEE GREENE.

Carnivorous Plants. IV.—EXPERIMENT No. IX.—Placed upon the center of the disk of a very vigorous and large leaf a small crumb of bread made from wheat flour, at 2:45 P. M., June 11, '79.

30 min. a few of the submarginal tentacles had bent slightly.
90 " " these tentacles were standing about at right angles with the plane of the surface of the blade of the leaf.
3 hrs. many of the marginal tentacles had moved some.
7 " a few of the submarginal tentacles were so inflected as to touch the specimen; also the marginal were much inflected.
10 " but little changed from the last note.
17 " all of the submarginal, marginal and outer disk tentacles had inflected to such a degree that nearly all of them touched the specimen; the edges of the leaf were also incurved greatly.
24 " leaf completely closed; substance of the bread soft and pulpy.

41 " there was apparently no further change.
47 " a few of the marginal tentacles had partly reflexed.
67 " the reflection was more marked but quite irregular, i. e., some of the tentacles were reflexed to a greater degree than others that commenced the reflex action at the same time; the substance upon the leaf was more liquid and not so opaque as at 24 and 41 hrs.
91 " all the tentacles were more or less inflexed but apparently were rapidly reflexing.
98 " there was but little change.
137 " many of the marginal tentacles were entirely reflexed; the outer disk and submarginal tentacles were, in the main, standing at an angle of 90° with the plane of the blade.
148 " mostly reflexed; tentacles and leaf were somewhat shrunken; substance formed a white incrustation on the disk; no secretion.
186 " the tentacles had again inflected slightly and one or two were so bent as to touch the remains of the bread *
220 hrs. the substance of the bread had turned a dark brown color.
244 " no trace of the bread remained.
388 " the tentacles were practically reflexed.
508 " the ends of the tentacles were somewhat dried and thus bent inward but the blade was natural; no secretion.
532 " there was but little change from the last note except that upon the tentacles that were not dried (some 5 or 6) the secretion had appeared.
580 " the whole leaf was nearly natural.
652 " the leaf, blade and tentacles, was natural with a copious secretion.

EXPERIMENT No. X.—A piece of fried steak was placed upon a leaf at 2:45 P. M., June 11, '79.

5 min. the submarginal tentacles and also the outer disk ones, for about ¼ the circumference of the leaf. had inflected and touched the meat; many of the remaining tentacles were much inflected.
30 " all of the submarginal tentacles had moved more or less.
17 hrs. all the tentacles had inflected and touched the specimen; the edge of the leaf was much incurved;
24 " the leaf was completely closed; meat white and pulpy.
68 " the tentacles were reflexing, a few being completely reflexed; the remaining part of the leaf not so soft as under 24 hrs.
92 " on one side all the tentacles had reflexed; on the other for about ⅓ the circumference of the leaf the tentacles were standing at an angle of 90° with the plane of the blade.
138 " the meat having dried had fallen off; tentacles were nearly all reflexed, and apparently somewhat dried.
162 " the leaf had assumed nearly it natural form.

*The cause of this secondary inflection I cannot assume to assert positively although it seems probable that in watering the plant the remains of the bread were soaked thus revealing some nourishment that had not already been absorbed.

286 " in all respects the leaf was natural as to the position of its parts.†

EXPERIMENT No. XI.—A drop of reagent acetic acid ($HC_2H_3O_2$–sp. gr. 1.04) was placed upon a leaf at 3:45 P. M., June 17, '79.

15 min. the solution had assumed the color of the leaf; 4 or 5 submarginal tentacles were inflected.

25 " many of the third row of tentacles had inflected so as to touch the drop of acid.

45 " all of the submarginal tentacles were inflected more or less; the spot where the acid was placed was somewhat depressed, the acid itself had disappeared.

75 " nearly all the submarginal and many of the marginal tentacles had inflected and touched the spot where the acid had been placed.

16 hrs. the whole leaf somewhat withered, the tentacles except the marginal still inflected as in the last note; leaf yellow.

25 " the marginal tentacles had all reflexed assuming the normal position; leaf apparently dead.

146 " the whole leaf was withered and dead.*

Maryland Fungi. I.—In the vicinity of Baltimore, Maryland, the months of June and July, 1880, were comparatively poor in fleshy fungi The very mild winter and early spring seemed to give promise that the coming season would yield an abundant harvest; but in the early summer several heavy rain storms either destroyed the mycelium or interfered with its development. The mycelium of a fungus is exceedingly delicate and plants are often exterminated from its having in some way been roughly dealt with. A m derate amount of atmospheric heat and moisture is all that is necessary to produce an abundant crop of fungi, an excessive amount of either will cause an almost entire failure. That they often fail us in the requirement of heat is proved by some coming in very cold weather. The largest and most perfect specimens of *Coprinus comatus*, Fr, that I ever saw came as late as December. As a further instance of their Arctic taste, showing the severity of the weather, a bucket of water that stood beside them was coated over with ice. They grew in a flower garden among the perishing and withered phænogamous plants which with the exception of a few very hardy ones had ceased to bloom.

In the early part of June, *Phallus Dœmonum*, Rumph., appeared about twenty yards from the spot where I found it in June 1878, but it was dwarfed in size. In the January number of the GAZETTE, 1880, I published a description of this plant under the name *Phallus duplicatus*, Bosc. The deep reticulated veil deceived me. After the publication of my article a very kind friend informed me of my mistake. *Phallus impudicus*, L., came a few days later, large and perfect. These plants are very imposing in appearance and generally select open

†The secretion did not appear on the tentacles until 24 hrs. after the last observation.

*The peculiar fact connected with this experiment is that while the submarginal and disk tentacles seemed to inflect and then become paralyzed and incapable of reflex action, those of the marginal row not only inflected but afterwards reflexed. The acid was rather too strong for a favorable observation of its true action upon the leaf.

places in woods. I have met with them beside highways that intersected densely wooded districts. The passer-by is attracted not only by their stately proportions but by their terrible odor. In consequence of their well merited reputation for loathsomeness we have reason to congratulate ourselves that they are never plentiful. One dozen plants would make a neighborhood uninhabitable. Crowds of flies generally hover around ready to devour the, to them, tempting gelatine with which they are enveloped. Beetles devour them rapidly, but insects with suctorial mouths seem to clean them up and put them in better trim for the collector. *Corynites Ravenelii*, B & C. which is also a member of this very interesting family of fungi termed *Gasteromycetes*, order *Phalloidei*, has appeared in the woods near Baltimore for the past five years, but never in large quantities. It rarely measures over 5 inches in height, but it is rendered attractive by its bright pink or red color. The spores are external and the apex is perforated as in *Phallus*, but it differs from it in having a pileus or hymenium confluent with the stem. It generally comes in the early part of June and continues at intervals until the last of August. It has an exceedingly disagreeable odor. One plant in a room is sufficient to disgust the olfactory nerves. The spores of these plants are in liquid and therefore cannot be carried through the air by the wind. What if we have an entomophilous division in fungi? Their fetid odor accompanied by a feast of gelatine is doubtless as necessary to them in the way of attracting insects, and thus disseminating their spores, as bright colors and honeyed nectaries are to flowers in the way of insect fertilzation.

In June and July the only plants that appeared in anything like profusion were *A.* (*Nancoria*) *semiorbicularis*, Bull., and *Russula virescens*, Fr. The latter with one or two exceptions was remarkably perfect in configuration and color. The same might be said of the former which crowded into lawns, giving among other evidence of its identity a stipe which had a distinct and separable pith. Its small hemispherical or expanded pileus, smooth, viscid and ochraceous, lights up the green grass on a lawn as if trying to compete with its more brilliant phænogamous neighbor, *Ranunculus bulbosus*.

In July I found several plants in the woods near Baltimore that I had never before met with. Some were new to science, others were not. Among the latter were *A.* (*Amanita*) *volvatus*, Peck, remarkable for the beautiful brown floccose edges of the lamellæ. *A.* (*Pleurotus*) *sapidus*, Kalch, grew in large imbricated bunches on an Oak stump. *A.* (*Psalliota*) *silvaticus*, Schæff, grew solitary and gregarious in open places in woods. This is quite a pretty fungus with not a very pleasant odor. It tasted strongly of bitter almonds.

A. (*Collybia*) *radicatus*, Relh., has generally been plentiful in all woods near Baltimore, but in July I found only one plant, that one was large and perfect. I do not know a more variable Agaric than this. The pileus is at times ochraceous, then various shades of brown, then bright yellow, then olivaceous, commonly 1½–2 inches across, smooth, scarcely umbonate, more or less glutinous; lamellæ adnate or with a decurrent tooth; stipe 3–4 inches high, pallid, often white, at times slightly striate, attenuated at the apex, more or less enlarged at

the base, rooting below. The perfect form is large, pileus fleshy 7–8 inches across, ochraceous with a brown and very decided umbo, rugose, excessively glutinous, cartilaginous and elastic; lamellæ sometimes edged with brown, adnate, forked, white, distant, thick, ventricose; stipe 7–9 inches high, cartilaginous, stuffed then hollow, reddish inside, twisted, splits with ease longitudinally, more or less furfuraceous, striate at the apex, reddish brown at the base, pallid above, moist, attenuated at the apex, enlarged at the base, rooting deeply; spores .00040X.00052 in., white. I have never met with more than six of these plants that combined all the botanical characteristics.

In the early part of July I found for the first time in the woods near Catonsville, Baltimore County, *A.* (*Clitopilus*) *orcella*, Bull. This is a very delicate fungus in appearance. The size varies in different localities. The pileus is usually from one to two inches across, white to cream-color, sticky in wet weather, dry and kid-like in dry weather, irregularly lobed, margin smooth and undulated, at first incurved, lamellæ close, forked, adnate or sub-decurrent, the lengthened ones taper and terminate on the stipe, delicate salmon color; stipe short, solid, enlarged at the base, at first central, but as the fungus seems to grow more rapidly on one side than on the other it often becomes eccentric and is twisted laterally near the base; spores .00022X.00048 in., salmon colored.

In August I found this Agaric in Carroll County, measuring 3½ inches across the pileus and growing in decided rings. In September I again met with it on the Blue Ridge Mountains, growing in large rings, but generally small. Some plants had a powerful odor of new meal, others were not marked by any peculiar odor, but all tasted strongly of cucumbers. At first sight one might mistake it for *Lactarius piperatus*, Fr., but upon examination the absence of milk with other botanical characters render its recognition conclusive. Once recognized it is impossible to mistake it afterwards. It is edible, and if eaten as soon as gathered it makes a desirable dish to those who love mushrooms.

Coprinus micaceus, Fr., growing in large cæspitose bunches took possession of the roots of an old *Morus alba* tree about fifteen miles from Baltimore. I remarked that in every section of the State, wherever I found it, it came profusely. In August I met with it in Carroll, Frederick, Washington and Alleghany Counties. In every instance growing either at the roots or in the crevices of the bark of the *Morus alba*. The bark of this tree seems to form a favorite nidus. In Carroll County, the trunk of one tree was adorned at intervals with bunches of this delicate little fungus. The trunk of another tree looked like a dark-brown column wreathed with fungi; the pilei glittering with granules. One could scarcely realize that this beautiful wreath-like design was one of nature's freaks. The spores are black with an oblique apiculus, .0003X.00028 in.—MARY E. BANNING.

Recent Publications.—TRIMEN'S JOURNAL OF BOTANY, February.—The original articles are as follows: Conclusion of Mr. Richard Spruce's Musci Præteriti; Notes on Abbott's Herbarium, by R. A.

Pryor; A new Hong-Kong Melastomacea (*Otanthera Fordii*) by H. F. Hance; Notes or Shropshire Plants, by W. Beckwith; Third Suppl. to Ferns recorded in Grisebach's 'Flora of the British West Indies,' by G. S. Jenman. Among short notes are recorded several new stations for British plants. Among the Proceeding of the Linnean Society appears a short notice of Dr. Master's "Conifers of Japan," and Mr. Bentham's classification of the *Orchideæ*.

American Journal of Science, March.—Dr. Asa Gray gives one of his very satisfactory reviews of Mr. Darwin's last work, "The Power of Movement in Plants." It is one of those reviews that are too long to re publish entire and too good to be mutilated. The book is one that every botanist should read and the wonderful powers of the seedling root tip are totally unexpected. As Mr. Darwin says in conclusion: "It is hardly an exaggeration to say that the tip of the radicle thus endowed, and having the power of directing the movements of the adjoining parts, acts like the brain of one of the lower animals." Dr. Goodale follows with several notes, the longest being a notice of Baron Ferd. von Muller's *Eucalyptographia*.

Torrey Bulletin, March.—Mr E. L. Greene emends the genus *Fendlera* so as to admit a new species which he names *F. Utahensis* It is the same plant that Mr. Watson named *Whipplea Utahensis*, but Mr. Greene after careful study of fresh material feels confident it is a *Fendlera*. Messrs. Ellis and Harkness describe several new Fungi, chiefly from New Jersey. Mr. G. Guttenberg has some notes on the Flora of Presque Isle, Pa.

The Vegetation of the Rocky Mountain Region, by Asa Gray and Sir J. D. Hooker.—We can but notice the receipt of this pamphlet, and promise a review in a subsequent Gazette.

Check List of North American Polypetalæ, by Harry N. Patterson.—Mr. Patterson has compiled this list principally from Mr. Watson's Bibliographical Index. It makes 20 closely printed pages, with three columns to the page. Being a professional printer, of course the typographical work is all that could be asked. For terms see advertisment.

Proceedings of the Davenport Academy of Natural Sciences, Vol. II, Part II and Vol. III, Part I.—These volumes reflect great credit upon the State, and the very enterprising academy that publishes them. So long as Dr. Parry is an active member, we may expect Botany to be well represented and so it is, with two of the ten plates being figures of *Lilium Parryi*, Watson.

A New Work on American Ferns.—Mr. Lucien M. Underwood has prepared a book on our native Ferns. It is intended as a manual for self-instruction and its methods are similar to those adopted in the study of Flowering Plants. The price of the book is but one dollar. Address L. M. Underwood, Bloomington, Illinois.

Botanical Gazette.

Vol. VI. MAY, 1881. No. 5.

Notes on Modes of Work in the Laboratory of Prof. de Bary in Strassburg, Germany. II. – Having in the last number of the GAZETTE given some statements as to the instrumental outfit of the Laboratory of Prof. de Bary in Strassburg, I desire now to add something as to modes of observation and culture of the lower forms of plant life. Commencing with Fungi, it is safe to say that the first desideratum is to procure living spores, to see mode of germination and trace the subsequent stages so far as practicable. The first question invariably asked me is, in what menstruum are these spores sown? This reply is safe. Try them in simple water first. It will be found that the spores of fungi parasitic upon living plants do well almost invariably in water, until the nourishment has been removed from the spore and reapplied to growth in the germinating tubes of the spores. But when this stage has arrived, a new menstruum must be found, and one as nearly like that of the juice of the plant on which the fungus thrives. For example, a weak solution of well cooked grape sugar would suggest itself for any of the species of fungi which infest the grape vine. In other cases a decoction of bones will produce a vigorous development of the fungus after the water has done its work.

Now how are the spores sown? In very simple contrivances. It appears to be an unfortunate outgrowth of the inventive, mechanical principle so largely characteristic of our race that we ignore simple appliances and run recklessly to complicated machinery for very simple objects. I keep before me as a reminder of supreme folly an elaborate brass growing cell for which I paid five dollars, and then found it was by no means so good as the simple paper "culture-well" used by de Bary and his disciples. This is nothing but a bit of bibulous brown pasteboard one-tenth of an inch thick, and 1.8 inches long by 1.1 inches wide, which has punched (by a gun-wad punch) in the center a hole something more than half an inch in diameter. This first of all must be boiled slightly before using to remove the suspicion of spores that might invalidate results obtained in the cell. This cell is then placed on a glass slide a very little larger, and the spores sown in a hanging drop of water on the under side of the cover glass, but this drop must not touch the paper at any point, lest the whole be drawn off and the cover and spores left dry. In such a cell cultures may be continued for a great length of time; long enough to solve the ordinary life problems for which they are designed. To keep the cell moist and the hanging drop intact and unwasted by evaporation, a little jet of water from time to time thrown on the paper outside the limits of

the cover glass will accomplish the purpose, and this must not be neglected while the object is under observation on the microscope, for it there dries very quickly. Now to keep the slide and its culture-well in good condition, you may have a little brass rack with two upright pieces, say ½ inch wide and three or four inches high for the ends and these connected by horizontal rods, two of which shall form the platform for one set of slides and two more half an inch higher for another set, so you may have several tiers over each other. Then on such a rack you place your slide, put this on a dish with a *little* water, and a bell-glass over all. Inside the bell-glass a bit of thin blotting paper may be placed, which being made moist will aid in keeping the contained air at point of saturation and so prevent drying of spores in cover glass; or, the slide with the culture well and its contained drop and spores, may be left over night on the microscope if desired, to observe one particular spore or point, provided the well is thoroughly moistened and then the bell-glass which covers the microscope provided with the wet blotting paper, just as the bell glass over the rack. So the whole instrument may be placed in a growing cell. Spores may however be sown directly upon a glass slide, without the culture-well, and cared for as those in the culture-well, but it is apparent they are liable to contamination from outside and undesired spores. One great source of error with the beginner in spore culture is, that he sows too many on a slide, and as they grow the whole becomes a confused and tangled mass, which can hardly be said to teach any mycological point with certainty. In this connection the student should read pp. 239 to 242 of Prof. Bessey's admirable text book on Botany, which I am almost tempted to say is the best work of its kind in the English Language. It is a perfect marvel of compact, well considered, biological doctrines, and whatever else a student has he should have this too. Leaf cultures, by which I mean producing a fungal growth on a leaf suspected to contain the spores or the mycelium. is simple enough. One merely needs to place the leaf on sand which has been previously boiled to kill germs, and then allowed to cool. The sand should not be kept wet or the leaf may rot too soon, but a simple dampness maintained. To do this I find a good plan is to place the sand and leaf in an unglazed clay flower pot dish, and this in a larger table plate, then keep an eighth of an inch of water in the latter; it soaks up through the clay dish and sand and moistens the leaf and air satisfactorily. I have now a leaf which three weeks ago gave no sign of perithecia, literally covered with a most promising crop of these or like bodies, and the result brought about by the simple process I have described. Of course over the leaf a tumbler or similar protection must be inverted to prevent evaporation and to keep away stray spores. If the plan proposed makes the sand too damp, simply use less water. To obtain spores from such a leaf, one merely requires to invert a bit of the leaf on a glass slide, then place a drop of water over the spore producing part The moisture imbibed soon causes an expulsion in sufficient numbers to continue the culture. If however one would have a starting point of absolute certainty he must remove an isolated perithecium, gently open it on the glass slide and allow the spores to escape in a drop of water. From this he may reason and observe with some assurance that he is right, and has the product of known spores.

Lichen culture receives a due share of attention. In fact the early researches of de Bary paved the way to the generalizations of Schwendener. Whatever view one may adopt as to the essential nature of lichens, their culture is of great interest. The favorite species for observation is *Endocarpon pusillum*, Hedwig. (*Dermatocarpon Schœreri*, Kœrber). These are collected in the late autumn, and enough of the clay removed with them to keep them alive in healthy condition until required. No water must be given them until they are taken for the cultures, otherwise the spores and small gonidia contained in the apothecia will be prematurely extruded. The spores and gonidia are to be sown in a flower-pot dish, on clay which has been thoroughly boiled, and then the surface made smooth as possible, which makes it easier to detect the first sign of the growing lichen. The lichens are then taken along with the surrounding clay, nicely bedded in sand and supports provided on which the edges of the inverted clay containing dish, may rest so that the surface of the moist clay is about one fourth of an inch from the lichen. The lichens are now sprinkled with water and the dish placed in position over them. Spores and gonidia will be extruded in association, and after 24 hours the dish may be removed and put under a bell glass in a light place which is not too damp nor too cold, i. e. temperature something above freezing. While the dish is inverted it should be turned round a little about every half hour to secure a distribution of the spores and gonidia over the surface, and small bits of "cover glass" may be placed here and there on the surface, which being removed will show under the microscope if the spores are escaping properly. The growing spores are handsome objects mounted in glycerine and quite instructive. These may be obtained by placing the glass slip over the lichens as the dish was placed, and afterwards setting it away in a moist place for a few days. It is to be observed that if the dish on which the spores and gonidia are sown be kept too moist and too warm at first, fungi will probably injure the culture. For fuller particulars of the process the reader is referred to Prof. Stahl's Paper, Beitrage zur Entwickelungogeschichte der Fletchen. Heft. II; ueber die Bedentung der Hymenial gonidien. Leipsic, 1877. Arthur Felix.

Pertusaria is also another favorite group, the gonidia of which are obtained by immersion of the brittle crustaceous mass in water, allowing them to multiply and form zoospores, and then placing them in association with the spores.

A plentiful supply of fresh water Algæ is always on hand. These are kept in glass jars, which stand in the windows and under cover of a bit of glass. Of course the water is frequently changed, and so with little trouble these may be observed in the various stages of growth, throughout the year.

The above hastily written notes will suffice to give an outline as to the modes of culture employed in the celebrated laboratory in Strassburg. Special inquiries demand special adaptations, and these will readily enough suggest themselves to an observer. A noteworthy feature is the extreme care observed by Prof. de Bary in keeping his growing solutions free from foreign spores by boiling and if need be, filtering before using. Boiled or distilled water is used for all ordina-

ry table work in the laboratory, and forceps, needles, and knives used in microscopic manipulation are treated to frequent boiling baths.—J. T. ROTHROCK.

Audibertia Vaseyi, n. sp.—A low, branching shrub; flowering branches stout and rigid, the herbaceous upper portions whitish, cinereous puberulent and viscid-glandular; leaves lance-ovate, acute or obtusish, 1 to 1½ inches long, narrowed into rather slender petioles ¼ to ½ an inch long, crenulate, not manifestly rugose, coated with a close white tomentum; heads of flowers about 6, in virgate spikes, 1 to 2 inches apart, lower ones subtended by a pair of leaf-like bracts; the inner floral bracts lanceolate to linear, setaceously acuminate; broad upper lips of the calyx furnished with a single conspicuous awn, the two teeth of the lower one likewise awned; corollas from ½ to ⅔ of an inch in length, exceeding the bracts.; stamens and styles exserted

Mountain Springs, San Diego county, California, June 1880. This plant is No. 500 of a large and fine collection made last summer in lower California by Mr. G. R. Vasey, in whose honor it is named.—THOS. C. PORTER, *Easton, Pa.*

Carnivorous Plants. V.—EXPERIMENT No. XII.—Placed upon a leaf a small fiber of muscle drawn from a piece of boiled beef, at 3 P. M., June 12, '79. The fiber was teased out from the mass of muscles and rolled into a ball having its diameter about 1-12 of an inch.

15 min. no change visible.
30 " a few of the submarginal tentacles had inflected slightly.
45 " the tentacles of last note nearly touched the specimen; a number of the other submarginal tentacles had moved considerably; a few of the marginal tentacles were also inflected.
1 hr. all the submarginal tentacles were more or less inflected and nearly all touched the meat; all but ten of the marginal tentacles were also inflected, varying in degree; the ten were still fully reflexed. To four of these another experiment was applied which will be fully explained in its proper place.
2 hrs. practically there was no change except that six of the ten marginal tentacles mentioned in last note had inflected slightly.
3 " no important change.
15 " all the tentacles were inflected and touched the meat except the four mentioned above which still normally reflexed.
24 " the edges of the leaf still remained normal.
48 " the meat upon the leaf seemed to be enclosed in a semi-transparent fluid containing fat globules as shown by removing a portion by a blunt needle and placing under the microscope. The globules were soluble in ether. The body of the meat itself had assumed a dark brown color. The tentacles and leaf remained the same as the last note.
72 " nothing but an opaque yellowish substance remained upon the leaf.
96 " there was but little change.
120 " the opaque substance upon the leaf had changed into a nearly transparent thickish fluid.

148 " the substance upon the leaf was nearly dry and the marginal tentacles exhibited a tendency to expand.
172 " the marginal tentacles were nearly all reflexed; the other tentacles were more or less reflexed.
195 " tentacles were all reflexed; all that remained of the meat was a dry scale which fell off when the leaf was touched.
212 " there was no further change.
272 " " " " " "
318 " the normal secretion had appeared on the tentacles.*

*In the above experiment an exception seems to appear to the rule that the margin of the leaf becomes more or less incurved according to the substance being digested; that substances easily digested excite the whole leaf and cause a much greater incurvation than those substances which are harder and require more time for digestion and absorption. It seems to me that the following explanation is plausible. Meat when placed upon a leaf seems to excite the marginal and submarginal tentacles to greater activity, causing the glands to pour forth a more copious supply of the viscid secretion. Thus may not the power of the exciting force be spent upon the exterior tentacles and their glands causing a more gradual inflection of the tentacles and less excitement to the leaf as a whole?

Referring to the amount of secretion poured forth by the action of various substances Darwin says:

"It is a remarkable fact that when an object, such as a bit of meat or an insect, is placed on the disc of a leaf, as soon as the surrounding tentacles become considerably inflected, their glands pour forth an increased amount of secretion. I ascertained this by selecting leaves with equal sized drops on the two sides, and by placing bits of meat on one side of the disc; and as soon as the tentacles on this side became much inflected, but before the glands touched the meat, the drops of secretion became larger. This was repeatedly observed, but a record was kept of only thirteen cases, in nine of which increased secretion was plainly observed; the four failures being due either to the leaves being rather torpid, or to the bits of meat being too small to cause much inflection, we must therefore conclude that the central glands, when strongly excited, transmit some influence to the glands of the circumferential tentacles, causing them to secrete more copiously."—[Insectivorous Plants, p. 14.]

The results of all my experiments indicate the truth of the above statement of Dr. Darwin and further that muscular fiber, insects and the like cause usually a more copious supply of secretion and less movement of the margin of the leaf than egg-albumen. The latter although exciting the glands somewhat, as do all nutritious substances, causes more marked incurvation of the margins, varying in degree according to the vigor of the leaf and the amount of substance placed upon it. This will be shown in the tabulated experiments of another series.

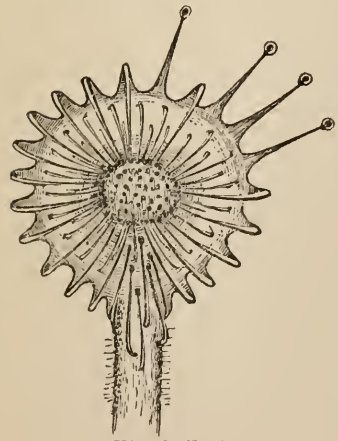


Fig. 2. (3X)

The process of closing in the experiment was so complete and typical that I have caused it to be figured as illustrating the position of the parts when closed (Fig. 2).

The four tentacles that remain reflexed show well the position of the marginal tentacles when there is no substance undergoing digestion. The explanation of a secondary experiment upon this leaf I reserve for special consideration.

The Gymnosporangia or Cedar-Apples of the United States, by W. G. Farlow.—The pamphlet bearing this title consists of thirty eight quarto pages of letter press and two plates, the latter illustrating five United States species of *Gymnosporangium*. It is published by the Boston Society of Natural History in their Anniversary Memoirs and is dated, Boston; 1880.

After giving a brief notice of the different forms of development or alternate generations ascribed to some species of *Puccinia*, and referring to the fact that Œrsted connected the European species of *Rœstelia* with those of *Gymnosporangium* as æcidial forms, the author enters upon the principal or descriptive part of the essay in which he collates and remodels the descriptions (with one exception) of our previously known species of *Gymnosporangium* and *Rœstelia*. With the descriptions are given the American and some of the European synonymy and bibliographical references. Also the principal known localities are recorded, and the references to the authority therefor made. Each description is followed by remarks concerning the habits, appearance, relations and distinctive features of that species. This part of the monograph abounds in the results of the authors observations and investigations and will be interesting not only to the mycological student but also to every lover of botanical science.

Podisoma and *Hamaspora* are not accepted as valid genera, the species sometimes referred to them being all included in *Gymnosporangium*. Of this genus, thus understood, seven species and one variety are described; the form producing globose swellings, on cedar twigs, similiar to those caused by *G. macropus*, being separated from *Podisoma fuscum*, to which it was formerly referred, and described under the name *Gymnosporangium fuscum*, var. *globosum*, Farlow. The familiar names *Gymnosporangium Juniperi*, Lk. and *G. juniperinum*, Fr. are made synonyms of *G. conicum*, DC., although the author expresses some doubt concerning the presence of this species in the United States.

Gymnosporangium speciosum, Pk. which occurs in the western mountain region on *Juniperus occidentalis*, and is described in the Botanical Gazette, Vol. IV., p. 217, is omitted, probably through some oversight.

Eight species of *Rœstelia* are described, but here again a doubt is indicated concerning the validity of *R. penicillata*, and a possibility of some error suggested concerning *R. hyalina*. How difficult it is to be fully satisfied in regard to the true characters and limits of species in these fungi may be inferred from the author's remarks under *G. clavipes*, *G. conicum*, and *G. fuscum*, var. *globosum*, as well as from the statement made that "European writers have not agreed among themselves as to the limits of their species." *R. Ellisii*, Pk. is placed as a synonym under *R. botryapites*, Schw., although it is difficult to make it agree with Schweinitz's description of that species. In order to reach the conclusion that the two are the same we must either suppose that the original description of *R. botryapites* is erroneous, or that Schweinitz mistook the gall-like swellings of the leaf for peridia and described them as such. Neither supposition would be very complimentary to the accuracy of Schweinitz; but it may be said, that if we admit the last one to be correct, the characters of *R. Ellisii* will agree passably well with the description of *R. botryapites*.

In the closing pages an account is given of some experimental cultures undertaken with the design of tracing, if possible, the connection between the species of *Gymnosporangium* and *Ræstelia*. Concerning the results of the experiments the author says, "Whether we consider the distribution of our species or the results of the cultures made, there is nothing to confirm the views of Œrsted as to the connection of particular species." In another place he also says, in reference to this subject, "Much more work remains to be done in this country, * * more extended and accurate knowledge of the distribution of our species is to be desired, and many more cultures must be made." "If it should be shown that several of our *Ræstelia* are perennial, a fact true with regard to most of our *Gymnosporangia*, and to grow in regions remote from species of *Juniperus* and *Cupressus*, then one could not help feeling that any connection between the two genera was probably accidental rather than genetic."

It is to be hoped that Prof. Farlow will continue this investigation until the number, identity and distribution of our species shall be satisfactorily ascertained and the supposed connection between the *Gymnosporangia* and *Ræsteliæ* shall be shown to be either real or imaginary. —CHAS. H. PECK.

Maryland Fungi. II.—On the first of August I fled from the tropical heat of Baltimore, but I confess that my flight had more than fresh air for its object. A ramble among the hills and the mountains of Maryland, offered as inducements a more extensive field for collecting, and a further knowledge of the geographical distribution of fungi. In the northwestern counties of this state, I found matters pretty much in the same condition as in Baltimore county. A very intelligent countryman with whom I conversed told me that he had rarely known such a poor season in the way of fungi. Only a few plants were to be met with even in the most favorable localities. But this state of things was not to last long. The third week in August brought a profusion and for three weeks the cryptogamic flora of Maryland was resplendent with beauty. Every lawn, flower garden and woods contributed its full share and the most avaricious collector could feel that his lot had fallen upon fair ground. Wherever I journeyed, "frog stools," so-called, seemed to become quite the fashion; though in some sections it was impossible not to perceive that I was considered "just a little Quixotic," as I heard some one say in a sly way. But for all this I received daily contributions from kind friends who were as might be expected forgetful of classification, and sent pilei without stipes and stipes minus the base. In this way I lost several beautiful Agarics that were new to me and which I never again met with.

At one stopping place I met with three very bright little boys. When I asked them if they knew anything about "frog stools" they replied: "Oh, yes, they knew all about them" I engaged them to come to the hotel the next morning and conduct me to, as they called it, "a grand place for frog-stools." I suppose they wished to assure me of their truthfulness as well as to earn a little money, for they went out early next morning, collected a quantity of fungi, and presented themselves at the door of the hotel saying: "We want to see that frog-stool lady that stays here." Luckily I was in the hall when I heard

the waiter roar out: "You three young scamps clear out this moment! Off with you! Have you gone crazy? Who ever heard tell of a frog-stool lady?" The moment I made my appearance one boy cried out: "There she be!" "That's her!" said another. "Didn't I tell you so!" said the third. The boys exulted over their success, while the waiter fell back looking ashamed of having so unceremoniously driven off my visitors. One boy had his hat filled. Another had an old tin bucket with the bottom half out, but stuffed up with the largest *A. nitidus* I ever saw. The third had a basket without a handle, and wherever there was an opening it was filled up with a large Agaric.

With some few exceptions the plants that I found were the duplicates of those that I had collected in past seasons near Baltimore. *A.* (*Amanita*) *muscarius*, L., with its usual warted and canary yellow pileus, varied in size according to the soil and locality in which it grew. *A.* (*Amanita*) *cæsarius*, Scop., with its smooth viscid pileus and striate margin, varied in intensity of color. At times it was scarlet, then bright sienna red; lamellæ free, yellow; stipe floccose, always more or less curved, and filled with a cottony stuffing; volva adnate at the base with a free margin. *A.* (*Amanita*) *solitarius*, Bull., did not always grow solitary as its name implies, it seemed to love company. I frequently met with three or four plants not more than nine inches apart, and in one instance two grew close together, but this is not the rule. The stipe of this Agaric is always solid, and the flesh is generally dry, but I once met with several plants that exuded a watery juice profusely when cut, and this too in very dry weather when there was no external moisture for them to absorb. *A.* (*Amanita*) *rubescens*, Pers., I found only in one locality with a dark red warted pileus, and stipe covered with red scales. *A.* (*Amanita*) *vaginatus*, Bull., was large and beautiful. *A.* (*Amanita*) *nitidus*, Fr., plentiful and very large.

The scaly cuticled sub-genus *Lepiota* was largely represented. The following species were to be found in quantities nearly everywhere. *A* (*Lepiota*) *Americanus*, Peck, I found in woods near Baltimore in 1879, but it was not to compare with the large and beautiful plants I collected in Carroll and Frederick counties. It varies in depth of color as well as in size. The largest measured 7 inches across the pileus. *A.* (*Lepiota*) *cepæstipes*, Sow., was in every period of its growth and even in its decline, delicately beautiful. I found it mostly in short grass on lawns and in flower gardens, growing in tufts. I remarked its slowness in coming to perfection I watched a tuft of young plants for two days, and although the atmosphere was warm and damp with occasional gentle showers, they did not expand until the morning of the third day. *A.* (*Lepiota*) *cristatus*, Fr., was plentiful and seemed also to prefer lawns and gardens. *A.* (*Lepiota*) *procerus*, Scop , measured 8 inches across the pileus. This is a variable Agaric in size as well as in color, and the pileus is often without scales. *A.* (*Armillaria*) *mellens*,, Vahl., grew in dense clusters on dead stumps. The pilei varied in size 4–9 inches across; stipes 4–9 inches high. *A.* (*Tricholoma*) *personatus*, Fr., also *A.* (*Tricholoma*) *præfoliatus*, Peck, were large, but not plentiful. *A.* (*Clitocybe*) *illudens*, Schw., was gorgeous. It took possession of old stumps, growing in large bunches, looking like a cloth of gold spread out for some grand entertainment of the Nymphs. The

pilei were 8–10 inches across; stipes 7–11 inches high. *A.* (*Pleurotus*) *ostreatus*, Jacq., grew in large bunches on the projecting roots of an old tree. How it survived the rough usage of the culinary department was a marvel. It grew in front of the kitchen door of a large hotel where hot and cold water were alike poured out. For one week it came successively. The spores were white, .0003X.00020 in. and so plentiful that during the process of drying its surroundings were as white as if flour had been sifted. *A.* (*Pholiota*) *adiposus*, Fr., appeared in large tufts on a *Morus alba* tree. The large bright yellow pilei, most of them 7 inches across, covered with dark brown superficial scales, supported on stipes 5½ inches high, one inch thick, were very beautiful and attractive. It grew not only in dense clusters in the fork of the tree, but aspired to the first branches. On the third of October I met with this Agaric growing luxuriantly in the crevices of the bark and on the branches of a *Morus alba* in an adjacent street. The spores are ferruginous; .00022X.00032 inch. *Cantharellus floccosus*, Schw., was beautifully represented in Carroll county. The largest measured 9½ inches across the pileus, stipe 10 inches high. It grows gregarious and in bunches, several pilei branching from the same stipe.

The beautiful little *Marasmius rotula*, Fr., still has mortuary associations from my finding it growing on dead sticks that had fallen across and around a marble slab that covered the remains of one of the first settlers in Carroll county, a native of Lancashire, England, and a person of some note, who died in 1796, at the good old age of 79 years. In some instances it grew in little tufts, in others it was distributed over the entire length of the sticks, giving them at a short distance the appearance of long spikes of tiny white flowers. Many of the pilei were immature, but those that were perfect measured from one quarter to three quarters of an inch across. The umbilicate plicate pileus with crenate margin; dark red or brown bristle-like stipe, wavy and often branched, combine in making the prettiest little fungus I know *Boletus luridus*, Fr., was large and plentiful also *Boletus modestus*, Peck. *Boletus fellens*, Bull., was small and scarce. I have frequently collected this plant in the woods near Baltimore very large, at times 12 inches across the pileus. Its size depends much upon the soil and the situation in which it grows.

On the Blue Ridge Mountains I found the same species of fungi that I had collected in lower lands as well as in the vicinity of Baltimore. The highest summit of these mountains in Maryland is High Rock. Its top is 1,500 feet above mean tide. Its slopes are inhabited by trees of greater or less size according to the depth of the soil. It was on one of these slopes that I collected the largest number of plants. *Fistulina hepatica*, Fr., about the average size was plentiful on the trunks of oak trees, and on old oak stumps. One could have feasted on this "vegetable beefsteak" had they felt so disposed. *A. orcella*, as I have already stated, grew in large rings, but dwarfed in size. *Cantharellus cibarius*, Fr., also grew in rings, but it was small. *Polyporus nidulans*, Fr., very small, and plentiful on dead sticks. *Lycoperdon gemmatum*, Fr., grew in large clusters, small, about half the usual size. That beautiful little fungus *A.* (*Clitocybe*) *odorus*, Bull., with its bluish-green pileus and sweet spicy odor, growing gregarious or in tufts, occupied a quiet and obscure nook. *Xylaria polymorpha*,

Grev., bristled up on the ruins of an old stump, looking at first sight as if the crumbling pile had even in its decay sent forth a profuse growth of dark brown twigs. Upon near approach, these, at times, variously branched twigs were found covered with white conidia, revealing the secret that they belonged to the Cryptogamic family. Several small specimens of *A. muscarius* assured one that they too could rusticate upon the mountains as well as on the plains. *Lactarius piperatus*, Fr., appeared solitary; it is generally gregarious. It was the first and only *Lactarius* I found during the entire season, and very small. *Russula virescens*, Fr., only two very small plants. In a narrow cleft not very far from the base of the mountain *Scleroderma vulgare*, Fr., was the sole occupant covering spaces three feet in diameter, growing in dense bunches, varying from the size of a walnut to 4–5 inches in diameter. *Lycoperdon pyriforme*, Schæff., grew singly and in clusters on old stumps and prostrate trunks of trees as well as on the ground; frequently bound together by the rooting fibers. The largest measured 4 inches in diameter, 6 inches high, in shape looking like a large inverted pear.—MARY E. BANNING.

Ferns of Arkansas. II.—

TRIBE BLECHNEÆ.

12. *Woodwardia angustifolia*, Smith.—Occurs plentifully in the swamps of South Ark. Fine specimens are found about Little Rock and Hot Springs.

13. *Woodwardia Virginica*, Smith —Found in the swamps of S. Ark. Noticed in Nuttall's report of the plants of Ark.

TRIBE ASPLENIEÆ.

14. *Asplenium pinnatifidum*, Nutt.—Occurs in N. W. Ark. upon limestone cliffs. *Scarce.*

15. *Asplenium Trichomanes*, L.—Is found in great abundance, and grows large in shaded moist places upon sandstone and limestone cliffs, in the upland portion of Ark.

16. *Asplenium parvulum*, Mart. & Gal.—This interesting species, considered for a long time a variety of *A. ebeneum*, occurs plentifully upon ledges of sand and lime in the N. & W. parts of Ark. It seeks the N. & W. sides of the valleys where it attaches itself to the moss covering the face of the rocks, and seems held in place by it. Dwarfed specimens are frequently found on rocks with S. exposure.

17. *Asplenium ebeneum*, Aiton.—Plentiful in the mountains of Ark. upon rocky hillsides in shaded woods. I have never seen it growing on the escarpments with *A. parvulum.*

18. *Asplenium angustifolium*, Michx.—Occurs sparingly in N. W. Ark. upon rich banks in shaded woods, or upon low cliffs. It may be regarded as rare in Ark.

19. *Asplenium Ruta muraria*, L.—I have never seen in Ark., but have specimens from Mr. Lesquereux, (Botanist of the Ark. Survey by D. D. Owen) said to have been collected in N. E. Ark. I have never visited the region.

20. *Asplenium Bradleyi*, Eaton.—Found sparingly upon escarpments and roofs of shelving sandstone rocks upon White River, and the ledges of secondary valleys. Also upon isolated ledges inland. One of the rare species of Arkansas.

21. *Asplenium Filix-fœmina*, Bernh.—Is represented in Arkansas by two varieties:

1. var. *angustum*, growing in the sunny and drier places in swamps and along the banks of creeks in woods. Common.

2. var. *commune* is common in wet and shaded places in swamps, and along creeks in shaded woods.

Both varieties are confined to the S. half of the State, or low country.

22. *Camptosorus rhizophyllus*, Link.—Plentiful upon shaded lime and sandstone cliffs in N. W. Ark. Grows luxuriantly, showing well the pilose apex. The auricles at the base are often found rooted, and with secondary fronds. Fronds from 12 to 15 inches long are not uncommon. I have never seen such fine specimens anywhere.

TRIBE ASPIDIEÆ.

23. *Phegopteris hexagonoptera*, Fee.—Abundant upon dry hills and in low ground throughout N. and W. Ark.

24. *Aspidium Noveboracense*, Swartz—Occurs in the swamps about Hot Springs, and probably throughout S. Arkansas.

25. *Aspidium Thelypteris*, Swartz.—Plentiful in bogs about springs in N. W. Arkansas.

26. *Aspidium cristatum*, Swartz.—Occurs in S. E. Arkansas. We have specimens from near Pine Bluff found growing in swamps by Mr. G. E. Lytle.

27. *Aspidium spinulosum*, Swartz.—Said to grow in rich woods by the Botanist of the Ark. Survey. I have not found any specimens.

28. *Aspidium acrostichoides*, Swartz.—Plentiful in the elevated regions of the State. Found upon the base of shaded cliffs, and on rich alluvial banks in moist situations, also in the swamps of S. Ark.

29. *Aspidium marginale*, Swartz.—Quite common upon shaded moist cliffs in the mountains of Ark. Grows very large. Inland and along streams.

30. *Cystopteris fragilis*, Bernh.—Occurs in N. W. Ark. upon shaded moist cliffs and rich banks. Seems to prefer sandstone.

31. *Cystopteris bulbifera*, Bernh.—Quite plentiful on shaded rocks in the mountains. Specimens from N. W. Ark. are sometimes nearly two feet long. Found on both lime and sandstone.

32. *Onoclea sensibilis*, L.—Occurs in spring bogs and upon low wet cliffs of White River with a North exposure. The form growing on rocks differs from the low ground form in having the sterile frond ovate in outline, the pinnæ oblong, obtuse and entire, the stipe no longer than the blade.

TRIBE WOODSIEÆ.

33. *Woodsia obtusa*, Torrey.—Upon cliffs and in rocky woods. Prefers moist shaded places, though found in dry situations. Inland and along streams. Grows luxuriantly.

TRIBE DICKSONIEÆ.
(Not Represented.)
SUBORDER CERATOPTERIDEÆ.
" HYMENOPHYLLACEÆ.
" SCHIZÆACEÆ.
(Not Represented.)
SUBORDER OSMUNDACEÆ.

34. *Osmunda regalis*, L.—Common in the swamps of Arkansas.

Growing with No. 35. Found as far North as the line of the Ft. Smith and Little Rock R. R.

35. *Osmunda cinnamomea*, L.—Swamps of South Arkansas, also on cliffs of sandstone in the extreme N. W. part of the State upon White River.

ORDER OPHIOGLOSSACEÆ.

36. *Botrychium ternatum*, Swartz, var. *lunarioides*, Milde.—Said to occur in the rich woods of Ark. We have not found it.

37. *Botrychium ternatum*, Swartz, var. *obliquum*, Milde.—Occurs in the low rich woods of S. W. Ark. The Arkansas form has rather broad sterile fronds. We have specimens from S. W. Ark. collected by Miss Mary Jones, of Montgomery Co.

38. *Botrychium Virginicum*, Swartz.—Common in the rich shaded copses of the upland portion of Ark.

39. *Ophioglossum vulgatum*, L.—In N. W. Arkansas upon limestone ledges 200 ft. above the valleys, also wet woods in rich soil.

Some Arkansas Trees.—Mr. Warder will find in the August and September numbers of the GAZETTE for 1880 an account of some specimens of *Castanea pumila* occuring in Hempstead County, which exceed in size those he found near Hot Springs. Specimens two feet in diameter are found in N. W. Ark., near Fayetteville. I am informed that a few specimens of *C. vesca* occur in E. Ark., but whether they are introduced or spontaneous I am unable to decide having never seen the specimens growing. I should like to know more about the occurrence of *Pinus australis* in Ark. I did not find it while in S. Ark. last summer, but *P. mitis* extends as far South as the Texan border. Should also like to know whether *Magnolia grandiflora* grows spontaneously about Malvern.

M. macrophylla and *tripetala* are common in Garland and adjoining counties, but I did not find *M. grandiflora* spontaneous. *Ilex opaca* grows much farther N. in Ark. than Malvern. It is common about Hot Springs.

I have passed from the N. to the S. part of Ark. in order to observe the change of tree covering, and find that it is governed by altitude, moisture, soil and other physical conditions, and that one can pass from one geological horizon to another and not be aware of it by a change in vegetation.

It is true that *Q. aquatica* and *Phellos* are not found in the N. part of the State, but they extend on the sub-carboniferous as far as the mountains about Ft. Smith, the distribution being termed by the physical rather than geological conditions. The same may be said of *Ilex opaca* and other species.

One could go from Malvern through Magnet Cove to Hot Springs and from the vegetation never dream he was passing across such a remarkable metamorphic region.

Q. Phellos and *aquatica* might be added to the Oaks of Garland Co., as they grow about Hot Springs.

This is not written in the spirit of criticism, but that I may know more about some species spoken of by Mr. Warder in March GAZETTE, p. 188.—F. L. HARVEY, *Ark. Ind. Univ., Fayetteville, Ark.*

Botanical Gazette.

Vol. VI. JUNE, 1881. No. 6.

Editorial.—In Dr. Rothrock's paper in the May number of the Gazette, page 205, fifth line from the top. *½ inch* should read *1½ inches*. In our next number Dr. Rothrock will contribute a paper in which he will contrast German and American modes of teaching.

Summer Schools of Botany seem to be multiplying in our country. Western teachers have begun to demand opportunities of this kind nearer than the Atlantic seaboard. Accordingly, the editor of this journal has thrown open the botanical laboratory of Wabash College to all who desire to spend six weeks in such work, the term to begin July 6th. No sooner had this scheme been well started than there comes a circular from the University of Minnesota stating that a summer school of Botany will be conducted there, beginning July 5th. This school will be under the charge of Prof. C. E. Bessey, than whom there is no western teacher more competent. We are only glad that these two schools are too far apart to feel in the slightest way each other's presence, for the attractions would be all too much on one side if the element of distance did not help to counterbalance.

The Syracuse Botanical Club has had a recasting of its officers, owing to the resignation of some of the former incumbents. The present officers are as follows: President, Mrs. S. M. Rust; Vice Pres., Mrs. Still; Cor. Sec., Mrs. Chas. Barnes; Rec. Sec., Mrs. J. M. Rowling; Treas., Mrs. A. D. Fairbanks.

A Guide to the Literature of Botany is being published in London, which will contain a classified collection of botanical works, including nearly 6,000 titles not given in Pritzel's Thesaurus. It is edited by Benjamin Daydon Jackson, Secretary to the Linnean Society. Orders should be sent to Dulau & Co., Booksellers, 37, Soho Square, London.

The Flora of Indiana, through *Compositæ*, has now been completed. This part of the work has been done, and well done, by Prof. Chas R. Barnes of LaFayette. With this number we give the first installment after *Compositæ*, the rest of the work being directly from the hands of the editors of the Gazette. Hence to them will hereafter be addressed any communication in regard to the Catalogue.

Mr. Joseph F. James, of Cincinnati, has presented to the Cincinnati Society of Natural History an interesting paper "On the Geographical Distribution of the Indigenous Plants of the Northeast United States." It makes a pamphlet of 17 pages and brings together in small space

a great mass of scattered observations upon this subject. We occasionally need some one with sufficient patience to look over whole libraries of scientific books and especially periodicals and cull out and put together in compact form all that pertains to some one subject. It saves all the rest of us a great deal of time, besides giving information that would either escape us or be contained in books we could not easily reach. Mr. James has done just this work, and what is almost as important, has carefully referred us to all the sources of his information.

New Plants of New Mexico and Arizona.—VICIA LEUCOPHŒA.—Annual; sparingly villous-hirsute throughout; 2 feet high, climbing by tendrils; stems wing-angled, sparingly branched, slender; leaflets 6, linear-oblong, entire, mucronate; stipules semi-sagittate; peduncles mostly 2-flowered; calyx teeth subequal, as long, or the lower a little longer than the tube; corolla 4 lines long, cream-color, the vexillum purple-veined; style very villous at the apex; legumes pubescent, 8-seeded.

Along streams in the higher mountains of south-western New Mexico, flowering in July and August. Not at all common, and but few specimens obtained. Very distinct from all our other species by its pubescence and the color of the flowers; but the latter in fading change to purple.

PHASEOLUS PARVULUS.—Stems solitary from a small, round, deep-seated tuber, slender, erect, 3–6 inches high, neither branched nor twining; stipules ovate-lanceolate, acuminate; leaflets an inch long, linear-lanceolate, mucronate, entire, or the lateral each with a more or less distinct lobe on the outer margin at the base; peduncles longer than the leaves, mostly 1-flowered; upper lip of the calyx entire, acute, the teeth of the lower longer, lanceolate; corolla ¾ of an inch long and narrow, deep violet; the linear legume nearly straight, more than an inch long, compressed, 8–10-seeded; seeds short-reniform, smooth, flecked with purple.

Abundant in deep woods of *Pinus ponderosa*, in the Pinos Altos Mountains, New Mexico, flowering in August. A diminutive, but with its large, violet corollas, most elegant species. The long peduncles are not rarely 2-flowered, bearing one at the end and the other an inch below it. The tuber is no larger than an ordinary hazel-nut, and never produces more than the one stem.

POLEMONIUM FLAVUM.—Stem 2–3 feet high, simple or corymbosely branched, clothed throughout with ample foliage, and nearly glabrous except at summit; leaflets from ovate- to oblong-lanceolate; inflorescence corymbose-cymose; pedicels rather densely villous, and somewhat viscid-pubescent; calyx cleft below the middle, the lobes triangular-lanceolate; corolla an inch long, campanulate-funnelform, yellow, with tawny red outside, tube very short, lobes rhombic-ovate, tapering to a sharp point and not at all rotate-spreading, their margin lightly undulate or erose; stamens ½–⅔, styles ⅔–¾ as long as the corolla; seeds many in each cell, scarcely winged.

Cold northward slopes of the highest Pinos Altos Mountains, New

Mexico, growing with *Delphinium glaucum*, Wats. and *Eupatorium grandidentatum*, DC., in flower and fruit Sept. 15, 1880.

It is hard to establish, and somewhat hazardous to propose new species of *Polemonium*. The claim of specific rank for this very striking and beautiful plant I base upon the shape and color of the corolla. No other species but *P. confertum* shows a corolla whose limb is really funnelform, that is, not at all spreading; nor has any other form red-yellow flowers which show no tinge of blue or purple or flesh-color, even in fading. Its nearest ally is *P. foliosissimum*, while it has more the look of *P. carneum*.

PENTSTEMON PAUCIFLORUS.—Stems 2 feet high, suffrutescent at base, and with a few strict branches; the whole plant clothed with a very minute puberulence which is retrorse, except upon the inflorescence, where it is spreading and glandular; leaves linear, sessile, 1–2 lines wide, the lower 2–3 inches long, the upper gradually shorter; racemes few-flowered (only one pedicel from each pair of bracts); sepals ovate- to oblong lanceolate; corolla tubular, more than an inch long, bright scarlet, strongly bilabiate, the three lower lobes usually somewhat reflexed; sterile filament smooth; capsules acuminate.

On a bluff of the Gila River in the extreme south-western part of New Mexico near the border of Arizona, in flower August 30, 1880. Probably rare, as only two plants could be found. The species belongs to the *Elmigera* sub-division of the genus, and the flowers look like those of *P. barbatus*, but the corolla is more deeply lobed and less stongly bilabiate than in that species, while the habit of the plant is very unlike that of any of the forms of it.

PENTSTEMON PINIFOLIUS.—Stems 1–2 feet high, shrubby and much branched, the lower ½–⅔ naked and marked with the scars of the fallen leaves, the upper branches densely clothed with linear-filiform, glabrous, sharp-pointed, one inch long leaves, which are attenuate below, but widen at the very base into ciliolate margins by which the opposite pairs are nearly, or most usually completely connate; the slender thyrsus few-flowered; pedicels and lanceolate-acuminate sepals glandular hairy; corolla an inch and a half long, narrowly tubular, scarlet, the nearly linear segments almost a third the length of the tube, the lower bearded, but not at all reflexed; capsule ovate-oblong, not acuminate.

Summits of the San Francisco range, back of Clifton, in south-eastern Arizona, growing in crevices of rocks with *Fendlera Utahensis*, Greene, and flowering in September, 1880.

A near relative of the preceding species, yet well marked, and of very different aspect, with its lower, woody branches naked, and the upper clothed with the dense pine-like foliage. The corollas are not at all strongly bilabiate, and in all the dried specimens their color has faded to yellow.

HABENARIA BREVIFOLIA.—Stem a foot or two high and stout; leaves numerous, mostly less than 2 inches long, all but the lanceolate uppermost ones loosely sheathing the stem; bracts linear-lanceolate, all but the uppermost exceeding the greenish flowers, which are numer-

ous, in a long, rather dense spike; lateral sepals linear-oblong, 4 lines long, the upper ovate; lip linear or linear-lanceolate, entire, rather acute, nearly a half inch long, shorter than the spur; anther retuse; pedicels of the pollen masses slender; glands orbicular; capsule oblong, 6–8 lines long, sessile; root fleshy-fibrous.

Dry southward slopes of the Pinos Altos Mountains, New Mexico, in open woods of *Pinus ponderosa*, in flower September 14th, 1880.

A striking species, in floral character most like *H. sparsiflora*, Watson, which grows by shady streamlets in the same region, but of very different habit, being nearly leafless, the foliage reduced to mere loosely sheathing bracts, their tips only somewhat leafy-spreading, and the stout stems flowering from near the ground.—EDWARD LEE GREENE.

Peltandra Virginica.—It is worth noting, if it has not already been done in some of our botanical serials, that Rafinesque in establishing the genus distinguished two species, *P. Virginica* and *P. undulata*. Modern botanists have accepted the former, and reduced the latter to a synonym. In the recent monograph of *Araceæ* by Engler *P. undulata* is restored to its distinctive position. Engler remarks that it has some similarity to *P. Virginica*, but differs in the inflorescence. The peduncle is shorter, not much longer than the petiole, the tube of the spathe is oblong not subfusiform, and the lamina of the spathe wholly green with no white anywhere about it. The female portion of the spadix is one-fourth to one-fifth the length of the male, while in *P. Virginica* it is two-thirds, and the ovarium is few-, rarely one-ovuled, while *P. Virginica* has never more than one. Both forms have been freely distributed as *P. Virginica*. The true *P. undulata* has been noted in specimens of Canby from Delaware, Boott from Boston, Schweinitz from Pennsylvania, Porcher from South Carolina, and Rugel from the foot of the Black Mountains in North Carolina. Both species seem about equally distributed geographically.—T. M.

Chlorophyll.—In NATURE for April 14 Mr. Sydney H. Vines gives an interesting review of the results of Dr. Pringsheim's investigations into the nature and function of this puzzling substance. Dr. Pringsheim some time ago startled physiologists by announcing that chlorophyll was not the direct agent of assimilation, but rather a screen for protoplasm which in the light thus subdued did the work. Of course such a careful and conscientious investigator must have had some sure ground to stand upon and hence this subject of the formation of chlorophyll has attracted a good deal of attention. These later observations, referred to by Mr. Vines, are considered by Dr. Pringsheim as confirming the views he had before expressed.

It may be of interest to our laboratory workers to know that Dr. Pringsheim has been using a new method of treating chlorophyll corpuscles. He treats them with a dilute acid, or warms them in water, or exposes them to the action of steam. The result is that chloro-

phyll escapes from the corpuscle, "together with certain fluid or semi-fluid substances which accompany it, in the form of viscid drops, leaving the ground substance of the corpuscle as a colorless, apparently protoplasmic, hollow sphere, with a much perforated wall."

By this means Dr. Pringsheim was able to get some little idea of the nature of Hypochlorin, a substance whose existence in chlorophyll-corpuscles he had previously announced. Under the acid treatment this substance appears as dark brown masses which eventually assume a crystalloidal appearance. From the fact that no hypochlorin can be detected when the corpuscles are warmed in water or exposed to steam it is inferred that it is decomposed by heat.

The effects of intense light upon the various cell contents are very interesting. It appears that although under ordinary circumstances the chlorophyll-corpuscles lose their color when exposed to intense light, such will not be the case in the absence of oxygen or in red light. This leads to the conclusion that this decolorization is a result of oxidation and the products gases.

An unexpected conclusion of Dr. Pringsheim is that in this same chlorophyll corpuscle are carried on the diametrically opposite functions of assimilation and respiration. The apparent contradiction is explained thus. The coloring matter of the chlorophyll-corpuscles absorbing certain rays of light permit the protoplasmic base of the corpuscles to do the work of assimilation; but this same absorbed light, thus kept from the protoplasmic base, can do the work of respiration. If therefore light is too intense these rays are not all absorbed and respiratory work overbalances that of assimilation. Mr. Vines states Prof. Pringsheim's principal results as follows:

"1. That the presence of chlorophyll favors the assimilatory activity of the chlorophyll-corpuscle in consequence of the absorption, by the chlorophyll, of light, which would promote respiratory activity.

2. That hypochlorin is the substance which is the first visible product of this assimilative activity, and that the other substances (starch, glucose, oil, tannin) which are found in chlorophyll corpuscles are derived from hypochlorin by oxidation."—J. M. C.

Some New Mexican Ferns. II.—Three Notholænas grow here, all of great beauty. The largest, *N. sinuata*. Kaulfuss, is a very peculiar fern, as well as a very handsome one. The fronds grow in clumps of five or six, and are from one to two feet long, while their extreme width is less than two inches. It is simply pinnate, the pinnae large, roundish, and crenate-sinuate, alternate on the rachis, of a bright green color above, and below covered very densely with a yellowish-brown pubescence which becomes darker as the season advances. It is from the color of the lower side that it receives its common name of "The Golden Fern." It usually grows among rocks on the hillsides, where it is exposed to the brightest sunshine. When it grows in the shade is becomes very tall and slender, and somewhat drooping. It fruits during October.

Notholæna Hookeri, D. C. Eaton, rarely reaches a foot in height;

the whole height being occupied by the stalk. The palmate frond is attached to the stalk almost at a right-angle. The upper surface is of a bright light-green and the under surface is covered with a pulveraceous substance, which gives it a very bright, light yellow color, growing darker with age. When the fruit is fully mature it forms a margin of an intense black, which contrasts finely with the general surface.

It grows at the edges of rocks, in dense and rather large tufts, and is the only one of my ferns which is handsomer than *Pellæa flexuosa*. It matures its spores quite early in October. Like *Cheilanthes Lindheimeri*, it curls up and becomes unfit for pressing almost as soon as it is removed from the soil.

Notholæna dealbata, Kunze, like *Cheilanthes lanuginosa*, grows in tufts on the perpendicular sides of rocks, where there seems to be no soil whatever, and in the deepest shade. It is seldom more than eight inches in height, the fronds finely divided, and very bright colored, the upper surface being green, while below it is of a pure white. When the fruit appears it is of the deepest black, and disposed in irregular, stellate, or radiating spots. Later the fruit becomes so abundant as to almost completely cover the back of the frond. A tuft of this fern, exhibiting the fronds in various stages of maturity, the colors varying from a pure white to an almost regular black, is a very pretty object. This is one of the earliest fruiting species.

Woodsia Oregana, D. C. Eaton, resembles our own *Woodsias* in its general appearance, but the stalks are more herbaceous and delicate. It is rather common, but not abundant, growing singly under the edges of overhanging rocks at the bottom of canons, in deep shade, and always near the water-holes. My variety differs from the type in having the stalks scaly, and in having narrow wings to the midrib. The latter peculiarity is probably connected with a habitual monstrosity which will be noticed in the conclusion. It is among the very early fruiting species.

The only remaining species is *Gymnogramme hispida*, D. C. Eaton. This is quite common and abundant. It grows in very high and dry situations, but in rich soil, and moderate shade. It seems to grow more luxuriantly in the shade, but so late is it in maturing that in such situations the chances are much in favor of its being destroyed by cold and dry weather before it has fruited.

It grows to the height of two to four inches, and, like *Notholæna Hookeri*, the frond exhibits its face in a nearly, or quite, horizontal position. The frond is pedate and densely hispid on both surfaces, but most so below. The upper surface is of a rich, dark green, the under surface of a grayish-green, and late in the season, both are tinged with red. The articulation is slight, and it is difficult to avoid separating the fronds from the rootstock in pressing.

In conclusion, a few teratological notes are in order. The teratology of ferns has of late attracted considerable attention, and I believe that Mr. Davenport is at present engaged in some special studies in this direction. Attention has been principally attracted to the bifurcation of the fronds, and in the recently established "Terato-

logical column" of that enterprising botanical journal, *The Bulletin of the Torrey Botanical Club*, Mr. Davenport and others have directed attention to a number of interesting cases of this deviation. I have been here favored with an excellent opportunity of contributing to this department. Bifurcation of fronds is so common here among certain species, as to have ceased to attract any attention. It is quite common in *Cheilanthes lanuginosa*. In this species the forking is always at the apex of the frond. The forks are quite slender, and divided in like manner to the lower pinnae. I do not remember to have seen a forking pinna in this species. But in *C. Eatoni*, while the apices are occasionally seen to fork, the common phenomenon is the forking of the pinnae. In all such cases the forking does not take place at or near the apex of the pinna, but usually below the middle, and often quite near the stalk. The forks are regularly divided, or, at least, quite as regularly as the other portions of the frond, which are themselves quite irregular in their mode of division. But by far the most interesting thing found in my collecting was a frond of this species which bore, at a distance of two or three inches below the lowest pinna, what appeared to be a branch, subtended by a bract. The branch, which, with the bract, was dead and withered when I found it, though the frond was quite green, was probably a sportive pinna, and the bract a much enlarged scale. But the specimen would have well repaid a little study. I laid it away too carefully, for I have been unable to find it since.

While the above-named species have a decided tendency to sport as described, the fern which is pre-eminently characterized by this tendency is the form of *Woodsia Oregana* which I find here, and which, for this reason, I think should be distinguished by name, as a variety. Decidedly more than half of the mature plants are found to be either forked, or presenting the peculiar appearance which invariably precedes the final forked condition. For the fronds are not forked in this species when young, but gradually approach that condition. As the process is most instructive, I will describe it, regretting that time will not permit me to make drawings. Many of my subscribers will receive specimens of the abnormal form, which will serve to illustrate. The lanceolate frond is entirely green and herbaceous. The rachis, as well as the upper part of the stalk, is narrowly winged, often very narrowly. Toward the upper part of the frond this wing becomes indistinct from the widening of the rachis. It widens so as to increase from in width of scarcely a line to near a quarter of an inch, and is surrounded by a narrow wing of incised, almost lacerate frond, this enlarged terminal segment giving to the frond a sort of a lyrate appearance. This segment becomes emarginate as the widened rachis divides, and as the recurved-spreading forks lengthen, the notch in the segment deepens, until we have two distinct and well defined forks. These forks never become long or slender, but exhibit a tendency to fork again in the same manner. Sometimes the pinnae exhibit the same kind of terminal enlargement, but I have not seen one reach the forked state. It is not pleasant to draw conclusions, but it seems as though the seat of the disposition to fork is in the rachis, and

that the extended growth of the segment is in accordance with that of the rachis. This would serve to make plainer the distinction between the frond and the leaf, in which the form of the skeleton is determined by the growth of the parenchyma, which demands support.

Since writing the above, I have found among my specimens of *Pellæa Wrightiana*, a number of specimens of that very rare fern (in the United States), *P. ternifolia*, Link. Upon a careful examination of this fern there seems to be no doubt of the suggestion of Prof. Eaton, that it and *P. Wrightiana* belong to the same species. I shall, therefore, distribute it among my sets, as far as the specimens will go, as *P. ternifolia*, Link, and *P. Wrightiana*, Hooker, as var. *Wrightiana* of the former species.—HENRY H. RUSBY.

Some Additions to the North American Flora, by Dr. G. Engelmann.—DICENTRA OCHROLEUCA, n. sp. Stem erect, 3–4 feet high, leafy, leaves glaucous, large (lower ones a foot or more long), 3-pinnate, ultimate divisions deeply cleft into lanceolate-linear lobes; flowers panicled on very short pedicels, about 15 lines long, ochroleucous; membranaceous sepals suborbicular; exterior petals slightly saccate at base, upwards narrower, somewhat concave below the acute tip, and scarcely spreading; inner petals widened above into a deep purple circular tip, crested with two very broad flat and elongated appendages; stamens subulate scarcely cohering.

In valleys of the Santa Monica Mountains near Los Angeles, Cal., where it grows with the rather rare *Ceanothus spinosus*, the root-stock of which, named red-wood, furnishes the principal fire-wood there.–Together with *D. chrysantha* this handsome species constitutes the subgenus *Chrysocapnos*, in which the crest, single and inflated in the true *Dicentrae*, is formed of two distinct lamellae, flat and large in our species, short and curly in *D. chrysantha*. This latter is a coarser plant with much smaller golden-yellow flowers (6–9 lines long) and deeply concave, spreading outer petals.

TSUGA CAROLINIANA, n sp. A small tree of the southern Alleghany Mountains with larger (6–8 lines long, ¾–1 line wide), darker leaves than the common Hemlock spruce, retuse or often notched at tip, without stomata above, beneath with two pale bands, each with 7 or 8 series of stomata; strengthening cells under the epidermis on keel, midrib and edges; cones 12–14 lines long, scales oblong, much longer than wide, in 8-13 order, spreading at right angles after maturity, broad bracts slightly and obtusely cuspidate; seeds (2 lines long) with numerous (15–20) small oil vesicles on the under side, twice shorter than wing.

Mountains of North and South Carolina, on dry slopes and ridges.—Smaller, stouter branched than *T. Canadensis*, from which it is always readily distinguished by its larger, darker, glossier, more retuse leaves and by its larger cones with wide spreading scales. It was first noticed in the mountains of South Carolina by Prof. L. R. Gibbes of Charleston in 1850, who sent specimens to Prof. A. Gray in 1856 and in an accompanying letter suggested for it the name of

Pinus laxa; he obtained it from both Carolinas; Prof. Gray himself had already collected it in 1842 on Bluff Mountain, N. C., in foliage only; and last year Mr. A. H. Curtiss again met with it "on Pinnacle Mountain, N. C., a long ridge commencing about 8 miles south of Hendersonville, probably 3–4000 feet high, where in groups of only few trees it occupies slopes near the summit, and even cliffs, while *T. Canadensis* abounds in the ravines of the same region; both species are cultivated side by side at the entrance of Mr. Middleton's place at Flat Rock, 3 miles from Hendersonville, where their branches interlock and their differences are strikingly exhibited." I have not seen any young shoots of this species and therefore can not say whether their leaves are spinulose-denticulate as they are in young plants of the two other North American species. These may be distinguished thus:

T. Canadensis: leaves of the mature tree smaller (4–7 lines long), obtuse with 5 or 6 series of stomata on each side of the keel below, destitute of any strengthening cells; scales of cone in 5/8 order, orbicular oblong with broad truncate bracts; wing very broad at base, tapering, scarcely longer than the seed which shows 2–3 large oil vesicles.

T. Mertensiana has larger leaves, with two bands each of 7–9 series of stomata; strengthening cells few on the edges and very sparse on upper and lower side of leaf; cones 6–12 lines long (not 1½ inches as sometimes stated), scales oblong, mostly a little narrowed in the middle, bracts slightly cuspidate; seeds smaller, with few oil vesicles, wings twice as long as the body of the seed.

YUCCA MACROCARPA, n. sp. Trunk several (1–4) feet high; leaves spreading, sharp pointed, concave, with entire margins; panicle subsessile with lanceolate, white, fleshy bracts; flowers not seen; fruits cylindrical not marked by any ridges, obtuse, pale yellowish, pulpy (4–6 inches long, 6–7 in circumference); seeds thick and large (5–6 lines wide, 1–1¼ lines thick), rugose-runcinated.

In ravines of the Santa Rita Mountains south of Tucson, Arizona.—Evidently closely allied to *Y. baccata*, Torr., which is found from Southern Colorado all along through Arizona to Southern California; distinguished from it by the the absence of fibres on the leaf-edges (I have rarely seen on one or the other this fibre detached from the edge, just as we find it sometimes in *Yucca gloriosa*, and *Y. canaliculata*, which ordinarily have entire edges), by the smaller, narrow bracts, and the obtuse, not rostrate fruit. The fruit is of the color of a yellow apple, rather pulpy, of a pleasant sweetish acidulous taste.

JUNCUS RUGULOSUS, n. sp. Pale green, transversely rugose and rough, stems 2–4 feet high from a stout running rhizoma, very weak, leafy; leaves septate; panicle lax, decompound, 6–8 inches long and wide; heads with hyaline bracts, 3–5–8-flowered; sepals linear-lanceolate very acute, nearly equal, the outer carinate 1-nerved, the inner 3-nerved; stamens 6, much shorter than sepals, linear anthers shorter than filaments; capsule exceeding the calyx, lanceolate, acute, 3-angled, 1-celled; seeds acute at both ends but not caudate, reticulate.

In a running streamlet at the foot of the San Bernardino Mountains, discovered by W. G. Wright, and seen there by me also in November.—With *J. asper* the only species of our flora with rough epidermis. It may be compared with loose panicled forms of *J. acuminatus* var. *debilis*, but is readily distinguished by its roughness and its 6 stamens, and then, no forms of *J. acuminatus* occur west of the great plains.

MONANTHOCHLOE LITTORALIS, Engelm., heretofore only known from coasts of the Gulf of Mexico, I found on the Bay of San Diego, Cal., where it grows with that curious *Batis maritima*, already noticed there 30 years ago by Dr. Parry.

Is Chenopodium viride, L., a good species?—It may not be advisable for amateurs in natural science to be tinkering with the limits of species, yet I cannot forbear, after more than a score of years of acquaintance, adding my honest convictions on the relation of the above named species with *Chenopodium album*, L. It was in my boyhood days, that, with hoe in hand I was called upon to wage a war of extermination on the "milfoil," or "mildew," as it is generally called by our farmers; and this, as I remember it now, was always the broad leaved form (*C. album*), and was to be found in almost every field and fence-row. During the last ten years the implement has been the botanical text-book, and I have had the pleasure of seeing the old enemy gradually growing less common. But its place is now being taken by a hardier, earlier-blooming and narrower-leaved form (*C. viride*, L.), which does not show any disposition, so far as I can discern, to become intermingled with its predecessor and weaker brother. Our modern authorities* appear to regard *C viride*, L. as a deep green, narrower-leaved and more mealy form of *C. album*, L.; while by some of the earlier authorities this order is reversed and *C. album*, L. is regarded as possibly not a good species, and that it may simply be a variety of *C. viride*, L. The main distinctions given are, that in the former, *especially when full grown*, the stem and leaves are a paler green, that the flowers are more dense on the branches, and that it blooms in July and August. Both are said to be extensively used as potherbs when in the young and tender stage.†

The following are the differences I have observed, and are my reasons for considering them distinct species:

(a) *C. viride* blooms from four to six weeks earlier.
(b) Its general growth is more erect, the branches assuming more nearly the vertical position.
(c) The whole plant is a deeper green.
(d) The leaves are narrower, varying from ovate-lanceolate to

*Gray, Manual of the Botany of Northern U. S., Fifth Edition; Watson, Revision of N. A. Chenopodiaceæ; Wood, Class-Book of Botany.

†See a German encyclopedic work of botany by Dr. G. W. F. Pancer, published about one hundred years since, in fifteen volumes, with copper-plates, and based on Houttuyn's translation and notes of the thirteenth edition of *Carolus A. Linne's System of Plants*. This is a monumental work of its period, and gives a scientific and popular description of all the plants then known.

broadly lanceolate, while those of *C. album*, L. are rhomboid. Both species drop the larger leaves early, many of them even before blooming. It is to this fact that I attribute the cause of our authorities regarding them as one species; when the leaves have fallen, so that but few of the smaller ones are left among the flowers, they are not so readily distinguished.

(e) These distinctions are constant, the two forms do not show a disposition to shade into one another. Among thousands of plants observed during the last ten summers, there never has been any doubt as to which species a given specimen belonged.

(f) *C. viride*, L., is a hardier plant, and a later immigrant into the Wabash valley; while it is annually increasing in abundance, its congener is gradually becoming less common.

(g) In regard to the mealiness, I have observed little constant distinction; probably *C. album*, L. is more mealy, especially among the flowers. The flowers are also a little larger in this species.—Dr. J. Schneck.

New Species of Fungi, by Chas. H. Peck.—Puccinia mirabilissima.—Spots small and dot-like or larger and subrotund, black or blackish-brown above; sori hypophyllous, few, small, pale reddish-brown; *stylospores* subglobose obovate or pyriform, obtuse, very minutely rough, .0009–.0013 of an inch long, .0008–.0009 of an inch broad, pedicel colorless, easily separating from the spore when mature; *teleutospores* intermingled in the same sorus with the stylospores, elliptical, obtuse, constricted at the septum, minutely rough, .0012–.0013 of an inch long, .0009–.001 of an inch broad, pedicel very long, colorless.

Living or languishing leaves of *Berberis repens*. City Creek Canon, Utah, July, *M. E. Jones*.

In this singular *Puccinia* both kinds of spores are intermingled in the same sorus, but the *Uredo* or stylospores are much more numerous than the others. They appear to be joined to their pedicels by an articulation, and when mature they easily separate from these like *Trichobasis* spores, although in general appearance they closely resemble the spores of many species of *Uromyces*. The pedicels of the *Puccinia* or teleutospores are usually two or three times as long as the spores. There are from one to six sori on a spot.

Puccinia Jonesii.—Spots pallid, indefinite; *hymeniferous fungus* with peridia short, crowded, wide mouthed, crenulate on the margin, the spores subglobose, orange yellow, .0008–.001 of an inch broad, *teleutosporous fungus* with sori mostly hypophyllous, rarely a few epiphyllous, scattered, at first covered by the epidermis, at length exposed, subpulverulent, black, the spores elliptical or oblong-elliptical, obtuse, substriate, minutely rough, scarcely constricted at the septum, .0012–.0016 of an inch long, .0008–.0009 of an inch broad, the pedicel very short.

Living leaves of *Ferula multifida* and *Peucedanum simplex*. Utah, May and June.

This species is respectfully dedicated to its discoverer, Prof. M. E. Jones. He remarks concerning the form on *Ferula multifida*, that the *Puccinia* always attacks the plant later than the *Æcidium* and that the fungus soon kills the leaf. I find no good characters by which to separate the form on *Peucedanum simplex* from the one on *Ferula multifida*. In both cases the *Æcidium* and the *Puccinia* occur on the same plant and even on the same leaf. I have therefore united the two as conditions of one species.

PUCCINIA ARNICALIS.—Spots pallid or none; sori amphigenous, clustered, crowded or confluent, reddish brown; *stylospores* subglobose, minutely rough, .0008–.0012 of an inch broad, reddish-brown, containing one or two nuclei; *teleutospores* intermingled with the stylospores, obovate or elliptical, obtuse, scarcely constricted, minutely rough, .0012–.0018 of an inch long, .0008–.00095 of an inch broad, concolorous, the pedicel very short, colorless.

Living leaves of *Arnica cordifolia*. Colorado. *T. S. Brandegee*. Communicated by *E. S. Rau*.

The fungus was found on plants growing at an altitude of 10,000 feet. The *Puccinia* spores are intermingled in the same sorus with the *Uredo* spores and are of the same color with them. The latter have no pedicels when mature. The sori occur chiefly on or near the midrib.

PUCCINIA TROXIMONTIS.—Spots pale or obsolete; sori amphigenous, scattered, reddish-brown or blackish-brown; *stylospores* subglobose, minutely rough, .0008–.0012 of an inch broad, reddish brown; *teleutospores* subelliptical, obtuse, scarcely constricted, minutely rough, .0011–.0014 of an inch long, .0008–.0009 of an inch broad, blackish-brown, the pedicel short and colorless.

Living leaves of *Troximon cuspidatum*. Utah. May. *Jones*.

This species is closely related to the preceding one, but differs from it in its scattered sori and in having the teleutospores in distinct and darker colored sori.

PUCCINIA ACROPHILA.—Spots brown, sometimes tinged with purple; sori scattered or crowded, reddish-brown; spores obovate or elliptical, obtuse, constricted at the septum, rough or verruculose, .0011–.0013 of an inch long, .0008 of an inch broad, the pedicel short and colorless.

Living stems and leaves of *Synthyris pinnatifida* Utah. *Jones*.

The fungus was found on plants growing at an altitude of 12,000 feet. The sori most frequently occur at or near the tips of the leaf segments, which suggests the specific name.

PUCCINIA MERTENSIÆ.—Spots none; sori amphigenous, reddish-brown, scattered or in clusters; spores elliptical, slightly constricted at the septum, obtuse, rough or verruculose, .0011–.0014 of an inch long, .0008–.0009 of an inch broad, the pedicel short and colorless.

Living leaves of *Mertensia Sibirica*. Colorado. *Brandegee*, Utah, July, *Jones*.

The fungus occurs on plants growing at an altitude of 11,000 feet. It is closely related to the preceding species and possibly future ob-

servations may justify their union. The spores in the present species are a little broader and more distinctly warted or roughened than in the preceeding one.

PUCCINIA PLUMBARIA.—Spots brown and indefinite, sometimes none; sori mostly hypophyllous, sometimes amphigenous, orbicular oblong or irregular, scattered or crowded, sometimes confluent, prominent, at first covered by the epidermis and then of a peculiar lead-color, blackish when exposed; spores obovate or elliptical, obtuse, slightly constricted at the septum, minutely rough, .0012–.0016 of an inch long, .0008–.001 of an inch broad, the pedicel very short, colorless.

Living leaves and stems of *Collomia gracilis* and *Phlox longifolia*. June and August Utah. *Jones*.

The form on Phlox has the sori more scattered and on both sides of the leaf, otherwise I find no satisfactory mark of distinction, and believing the two to be forms of one species I have united them. The dark sori, while covered by the thin epidermis, have a peculiar leaden tint which suggests the specific name.

PUCCINIA CALOCHORTI.—Spots blackish or none; *hymeniferous fungus* with the peridia crowded, short, clustered, the spores subglobose or angular, yellow or orange, about .0008 of an inch broad; *teleutosporous fungus* with sori scattered or crowded, oval or oblong, black, the spores subelliptical, obtuse, slightly constricted at the septum, rough, .0014–.0016 of an inch long, about .001 of an inch broad, the pedicel short.

Living leaves of *Calochortus Nuttallii*. Utah. June. *Jones*

The species is related to *P. Lojkiana*, but our fungus has the spores smaller, more obtuse and not so coarsely warted. Both the *Æcidium* and the *Puccinia* occur on the same leaf.

Isoetes lacustris.—The following note is so interesting that we reproduce it from *Nature* (April 7) and would ask our collectors to make note of any similar behavior on the part of this species in our own country:

In a paper read before the Academy of Sciences of Paris (Jan. 10, 1881.) M. E. Mer calls attention to the peculiar conditions under which different forms of this fresh-water plant seem to originate in the Lake of Longemer. The basin of this lake was once occupied by a glacier, and now presents several different sorts of bottom. The soil to a depth of two to three metres is composed in part of a gravel formed of rock *debris* united by an iron cement, in part of ancient moraines, or where near the surface these will be mixed with the remains of plants and form a pretty tenacious mud. In all these situations Isoetes is to be found, but the plants differ most remarkably both as to their form, their structure, and their mode of reproduction as they are found in the different habitats. Taking the leaf development as a guide, four varieties are easily discerned:—(1) *humilis*, growing sparsely in the gravel and sterile shallows, the leaves are not only few in number, but always of diminutive dimensions; sporange generally wanting or represented by a small cellular mass which rarely ever

forms a propagule, and then these with puny leaves; (2) *stricta*, found on the borders of the lake or in the old alluvial, therefore in less sterile quarters than the preceding; leaves more numerous, stout, but still of small size; (3) *intermedia*, growing on ground formed of a mixture of mud and clay, either on the borders of the lake or at a depth of from one to two metres; leaves quite intermediate in character between the previous variety and the next; (4) *elatior*, growing on the clayey depths, with long leaves. The first form is always found isolated, and as to its asexual reproduction there is nothing more to be said; but the other three, according as they are subject to more or less heat, present each three varieties characterized by the mode of reproduction. 1. *Sporifera*, isolated individuals, mostly furnished with well-developed sporangia, stem large, roots numerous, leaves large. 2. *Gemmifera*, few fertile sporangia, but most of the leaves are furnished with propagula, and these well furnished with leaves, generally dextral, stem fairly developed. 3. *Sterilis*, indviduals growing in compact masses, stems and roots slender, leaves not numerous, long and narrow, fertile sporangia very rare, and more often undeveloped masses of cells or abortive propagula. It would seem as if these facts had a practical interest to the collector, who may find in them a guide as to where to look for fertile specimens.

Bebb's Herbarium Salicum.—We are in receipt of the first fasciculus of Mr. M. S. Bebb's *Herb. Salicum*. Any one who has ever seen Mr. Bebb's specimens knows just how perfect and complete this bundle is. In his work towards a monograph of North American Willows, Mr. Bebb has shown rare judgment and still rarer patience. How else could he have undertaken to let a little light through that dark maze of forms which meets the eye of every botanist who has dared to look at willows? Nowhere do lines between species run so indistinctly, in fact it can hardly be said that there are such lines. Now Mr. Bebb proposes to help us just where we so much need help, and every botanist should make it a point to contribute notes and specimens that this monograph may be as exhaustive as possible. Accompanying the very complete specimens of this fasciculus are full descriptions and very many drawings of leaves and capsules, the latter enlarged to a uniform scale of twelve diameters.

We can note but a few of the many things that catch a botanist's eye in looking through the bundle. One of the most satisfactory results is the settling of Muhlenberg's *S. myricoides*. Botanists have been inclined to give it specific rank, or to make it a variety of *S. cordata*, but Mr. Bebb shows conclusively that it is a hybrid from *S. cordata* and *S. sericea*.

Another very interesting hybrid is that from *S. petiolaris* and *S. candida*, species so dissimilar that a cross was hardly to be expected. In case it should become the custom to give distinct names to such hybrids, Mr. Bebb desires to call this beautiful willow *S. Clarkei*.

A new species is proposed under the name *S. glaucophylla* and there seems to be no reason why it should not stand. Mr. Bebb has

long been hunting a place for it, first making it a variety of *S. cordata*, then of *S. Barclayi*, but it seems specifically distinct from both. It is most nearly related to *S. cordata*, but is by no means like it in habit and can always be easily distinguished. It would more likely be mistaken for *S. discolor*.

Many other forms, especially hybrids, could be noted, but those given will suffice to show the nature and importance of the work. Again would we urge all botanists who are interested in the welfare of their science to communicate with Mr. Bebb in regard to any specimens or notes they may have that would be a help in studying our willows.—J. M. C.

Leavenworthia in S. W. Missouri and N. W. Arkansas.—On a recent trip to S. W. Missouri I was rewarded by finding a species of *Leavenworthia* growing upon the *debris* of eroded limestone rocks in rich springy soil. Though growing in rocky places it was not found on the top of flat rocks, the situation usually given in the books for them. I have hunted for them upon all the flat top rocks I could find in N. W. Arkansas and S. W. Missouri and have not found a single specimen in such a habitat. The specimens were growing with *Arenaria Pitcheri*, *Sisymbrium canescens*, occasionally a specimen of *Draba cuneifolia*, *Allium striatum*, *Oxalis violacea*, *Astragalus Mexicanus* and *A. distortus*. The following is a description of the species as made in the field from fresh specimens:

Root single, annual and running deep into the soil; leaves all radical and lyrate-pinnatifid; peduncles radical, one-flowered, elongated, sometimes as many as 20 from one root, 2′–5′ high. Sepals more or less reddish-brown with a shade of purple; some were reddish brown the whole length, others have only a reddish-brown tip with a greenish-yellow base, while others are entirely greenish-yellow. Petals vary from reddish-brown to yellow like the sepals. Those flowers with dark reddish-brown sepals have the corolla distinctly reddish; some have a white blade and yellow claw, while some are light yellow throughout. The corolla has lighter corresponding shades than the calyx. Silique narrow oblong-linear, elongated after flowering, sometimes 1½′ long, flattened parallel to partition, straight in perfect specimens; sometimes torulose in imperfect specimens. Style about as long as the width of the pod and club shaped; pod often shows a purplish tinge. Seeds broadly winged, orbicular, flat, from 1–9 in each cell. Radicle straight, at an angle of 45° or even at a right angle with the cotyledons. I am inclined to think the radicle becomes more oblique as the seeds mature.

The characters seem to apply to *L. aurea*, Torr., as described in the GAZETTE, March, 1880. I obtained excellent fruit specimens and fair flower specimens, but only a limited number of either. I can furnish a limited number of fruit and flower specimens to botanists interested in this genus for twenty-five cents, the specimens including both flowers and fruit and the postage paid.—F. L. HARVEY, *Ark. Ind. Univ., Fayetteville, Ark.*

Recent Periodicals. — TRIMEN'S JOURNAL, April.—A new variety of *Carex pilulifera*, L. (var. *Leesii*), by H. N. Ridley; The Morphology of the Leaf of *Fissidens*, by Richard Spruce; A Revision of the Indian species of *Lecea*, by C. B. Clarke; Notes on Shropshire Plants, by William E. Beckwith; A new Hong-Kong *Anonacea* (*Melodorum glaucescens*), by H. F. Hance; New British Lichens (*Lecanora rhagadiza*, *L. albo-lutescens*, *Pertusaria spilomanthodes*), by Rev. W. Johnson; Bryological Notes, by W. West.

AMERICAN JOURNAL OF SCIENCE. May.—Dr. Gray gives some interesting notes on the germination of the seedling of *Welwitchia*. Mr. F. Orpen Bower has been investigating the structure and development of the mature embryo and seedling from plants germinating at Kew Gardens. Two interesting facts are mentioned as having been brought to light by Mr. Bower. One is that at the beginning of germination a fleshy outgrowth is produced from the caulicle and remains in the axis of the seed, surrounded by endosperm, even after the liberation of the cotyledons. This Mr. Bower calls "the feeder," from its probable function. Morphologically it is like the "peg" in germinating squashes which has for its function the splitting of the seed coats.

The other interesting fact is that the two leaves of *Welwitchia*, so long thought to be cotyledons are not cotyledons at all, but permanent foliage leaves. The seedling *Welwitchia* after unfolding its cotyledons at once produces a two-leaved plumule, which decussates with the cotyledons. It is these leaves that remain, while the cotyledons drop off.

AMERICAN NATURALIST, May.—Some interesting investigations On the Evaporation of Water from Leaves (Transpiration) are published. The work was done in the Botanical Laboratory of Iowa Agricultural College by Miss Ida Twitchell. It is just such work as we would expect to see coming from Prof. Bessey's laboratory. The steps are carefully taken and seem to point to the idea that transpiration is more a physical than a vital action and not so very much different from ordinary evaporation after all.

TORREY BULLETIN, May.—Mr. Chas. Peck describes two new species of Fungi, one under a new genus (*Ascomycetella quercina* and *Polyporus lactifluus*), accompanied by a plate. Messrs. Ellis and Harkness add four more names to the list of Fungi (*Sphaeronema capillare*, *Sporidesmium Rauii*, *Mytilinidion Californica*, *Sphaeria consociata*). The last two have the honor of growing on the foliage of the "Big Trees" of California. Prof. J. C. Arthur gives an account of the Lapham Herbarium, now deposited in the State University of Wisconsin at Madison. A sketch of Prof. Alphonso Wood is given with a portrait.

NATURE, April.—Articles on *Isoetes lacustris* (April 7) and Chlorophyll (April 14) are referred to elsewhere.

COLUMBIA COL
HERBARIUM
NEW YORK

Botanical Gazette.

Vol. VI. JULY, 1881. No. 7.

Editorial.—The genus Senecio contains more than 1,000 species, but still new ones are being described.

On page 224 in the last Gazette it is stated that *Yucca macrocarpa*, Engelmann, has seeds "rugose-runcinated." Of course the manuscript shows "rugose ruminated."

Mr. W. W. Bailey has been appointed Professor of Natural History (Botany) and Curator of the Herbaria at Brown University, to meet the requirements of S. T. Olney's will. It is a well deserved appointment and one very gratifying to Prof. Bailey's friends.

Dr. Gray is back in England again from his trip on the Continent, with headquarters, as formerly, at Kew.

A late copy of *Nature* announces the death of Dr. Ludwig Rabenhorst of Meissen (Saxony). He was a well known botanist and editor of the *Hedwigia*.

Mr. John Sanderson of Natal has just died. He was an indefatigable explorer of the South African flora and in his honor was named the genus *Sandersonia*.

Professor P. F. Reinsch has for some time been studying with the microscope sections of coal. Having made his sections in a peculiar and difficult way he has obtained 1,200 perfect ones, and with these he upsets all our previous notions in regard to the nature of coal. The Professor does not expect us to accept his views, for we are creatures of habit, but he does expect us to help observe and "carry the light of science into this dark field of hereditary beliefs." The central ideas are as follows: The organic forms of the coal are Protophytes, that is, "plants without distinct cell structure, with sporadic enclosures of spores and tissue fragments of cryptogamous and still higher plants." Prof. Reinsch groups these forms into seven generic types, and fifty-two specific forms are described and figured. The well known rapidity with which such low forms under favorable conditions propagate would seem to account easily for the enormous accumulation of the vegetable material of our coal measures. The different kinds of coal might also be explained by the prevailing protophytes of the stratum. In the last *American Naturalist* George A. Koenig gives a good review of this work of Prof. Reinsch.

Dr. Alexander Dickson in the last *Journal of Botany* considers, with the help of two plates, the morphology of the pitcher of *Cepha-*

lotus follicularis. With regard to the morphology of the parts of the leaf of *Nepenthes*, he comes to the conclusion that in this well known genus "we have to deal with a leaf the lamina of which is interrupted in the middle of its course by becoming reduced to its midrib, and that while the proximal portion of the lamina retains its typical form of a flat expansion, the distal portion becomes peltately expanded into a funnel or pitcher."

As we are going to press Dr. Farlow's monograph on New England Algæ comes to hand. As it is so late in the season he distributes them without binding. As soon as copies can be bound they will be on sale at the Naturalist's Bureau, Salem, Mass. An artificial key makes it of use even to those who have no intimate knowledge of the structure of Algæ. Every person on the sea shore this summer, who is at all scientifically inclined, should have a copy of this monograph.

Home and Foreign Modes of Teaching Botany. III.— Though somewhat out of the usual order for a botanical journal to discuss modes of teaching, I offer the following, on the simple ground that the time appears to be ripe for it. Until within the last ten years botany in the United States has been with the many students and with most of the teachers a mere science of nomenclature, hardly rising to the dignity of true systematic study. This doubtless arises from two causes: first, because of want of means to enter upon other fields of work in the vegetable kingdom; and second, because the mass of students simply caught the enthusiasm of the great teachers whose energies were bent upon reducing to some respectable order the vegetable cohorts of the land, though the former for want of time were unable to reach the inspiration which was founded upon the deepest insight into the anatomy and physiology of plants. Even this measure of attainment is commendable and has at least led to the capacity for discovering what others have to say about any given plant, and so paved the way for the more thorough modes of these coming years. We are commencing to feel that even without a name a plant may teach us much that is worth knowing, to which knowledge it is all the better that we shall add the name as well.

How shall we teach botany then that it may meet modern wants, and associate itself properly with its biological ideas which are now doing so much to shape modern mental culture?

Our best appeal here is to the facts, and I believe I am safe in saying that the whole, or nearly the whole American impulse in botany owes its origin, directly or indirectly, to Cambridge. Certainly it has been a prolific teacher of teachers; so prolific that we may well ask its methods. These may be summed up in the one sentence: *The teacher will keep you on the track, but you must find out for yourself.*

The same fundamental idea characterizes the celebrated laboratories of Germany, and notably, the oldest and probably the most productive one, that of Prof. deBary. One essential difference obtains however between the American and German laboratories; we give

systematic, they anatomical and physiological botany greater attention. Herein I am persuaded they are correct. I believe I am safe in saying that a man might there successfully pass his examination for the degree of Doctor of Philosophy and yet not be able to name "on sight' three hundred species of plants; but he has the training which enables him to determine all, when there exists a necessity for doing so. We on the contrary insist on the recognition of plants, without inquiring too critically how much the candidate knows about them.

Systematic botany must, if it represents a strictly natural system, be founded on a nice appreciation of the entire organization, the life history of the individual, and its relation in present and past time to allied plants. This then is the highest, all embracing trend botanical thought can assume. In aspiring to this we neglect the foundation. The German school builds a solid foundation and leaves the student mainly to give the superstructure such shape as he will. Between the two there can be but little doubt as to which is the more philosophic, or certainly as to which is the better mode of training for original investigation.

The laboratories of Harvard, Michigan (two) and Iowa have taken the initiative in introducing needed reforms, and already a most promising crop of fruit is the result. The labors of Torrey, Gray, Engelmann and Watson have placed our phænogamic flora on firm foundation for subsequent workers, and the question now is how are these to be trained? First of all, by indoctrinating them with the idea that they will make the most substantial mental gains if they study each individual plant exhaustively. How far this shall be carried is a question for the judgment of the teacher, but it is the idea the student should be saturated with "through and through." It is the foundation of his foundation, and makes critical investigation press upon him with the weight of an ever present duty. Yet this is just the hardest lesson every American teacher finds it to inculcate. Does it indicate a radical defect in the earlier culture, or is it a race peculiarity?

Another idea in this connection is worthy the consideration of teachers, *i. e.*, that take any plant, its life history is but imperfectly known, and the student may be encouraged to believe that he can in it find something hitherto unknown, if he will but hunt for it. The readiest possible confirmation of the absolute truth of this statement is found in that noble series of works Mr. Darwin has given the world. So valuable have they been that hardly a branch of natural science has failed to acknowledge their influence. Yet how few plants have been treated upon by them! This is essentially the idea upon which de Bary's instruction is predicated, and witness the discoveries, among the commonest plants, that have followed his systematic questioning point by point the life history of each one.

Apart from this honest study of one very narrow field, the lectures of the professor are not to be regarded as points confirmed for the special benefit of the student to save labor on his part, but rather as outlines of the facts the student must verify. The value of such training, embracing as it does a survey of the large part of the field

cannot be overestimated. With us the teacher does the asserting in his own, or other authority, the pupil simply accepts, and that ends it until examination day. But what critical scholarship, what mature judgment, has been, or can be formed by such a process?

No botanical laboratory is worth the name which does not include in its outfit a good working compound microscope, along with chemicals for each student, and type specimens, and a modern set of standard botanical works of reference which should be freely used. No botanical course, consisting of lectures exclusively can rise to the dignity of being contemptible, if its object is to make botanists or to even give a certificate of botanical proficiency. There is no biological laboratory of England where students investigate more critically the teachings of the chair than in that of Prof Huxley, nor, on the other hand is there any one which is producing now and promises in the future to produce a greater impression on the thought of the age. I conclude then that the time has fairly come for a change in our modes of teaching, and until we do adopt the methods of work which are now so universally followed abroad, we may expect to see an annual exodus of our most aspiring students to foreign seats of learning. Instead of concealing how much we lack of the true standard, the friends of liberal, practical, botanical education can do no more effective work than by agitating the subject until the remedy is furnished. There is yet one more aspect in which we may view this question. Popular ideas connect botany only with *flowers*. It is proper for us to insist that it produces *fruit* as well, that no science is more intimately associated with our food, drink, raiment and medicine than this. The public mind should be informed that it takes cognizance of practical forestry, of the diseases of our cereal grains, and indicates what we are to do in these directions.

That the impression should have prevailed so long that botanical study brings nothing of utility with it is largely our own fault. It is just what we have made it. When we work these needed reforms and show the public that we are in earnest, we may expect to see our science properly represented in every college of the land, but not before.—J. T. Rothrock.

Some Additions to the North American Flora, by Dr. G. Engelmann.—Eschscholtzia Californica.—The different forms of this common and extremely variable plant deserve to be studied more carefully at their homes, where they are found in such untold abundance. It is quite possible, as indicated in the Flora of California, that the several species into which it had been divided, may be sustained by reliable characters. All the forms, however, are said to be annuals with colorless juice. Now, on the sandhills of the ocean, quite close to the well-known Cliff-house near San Francisco, I found last October a form with long perennial roots, ½ inch thick, abounding in orange-colored juice, and bearing several stems; leaves shorter than the internodes, often opposite, flowers 1 inch wide; torus broadly margined, capsule about 2 inches long, seeds reticulated. In most

respects it represents the typical form of *E. Californica*, but the perennial rootstock seems to distinguish it; annuals, to be sure, in mild climates not rarely last for several years, e. g. *Solanum nigrum* in southern California, but in these the stem becomes ligneous and no rootstock forms, the normal tap-root not losing its characters, even if it does become 3 or 4 years old. It is barely possible that *E. Californica* is one of those perennials which will flower as seedlings in the first years and that then the aridity of the climate in many instances kills it, root and all; but if so, why has this occasionally (?) perennial character not been observed before?

PORTULACA SUFFRUTESCENS, n. sp.—Erect, about a span high from a stout, branching and apparently perennial rootstock, ligneous at base; leaves terete, about 1 inch long, with sparingly hairy axils; flowers clustered at the end of the branches, large (7 to 10 lines wide), yellowish buff colored; petals obcordate or emarginate; stamens numerous; filaments, like the 5 or 6 stigmas, red; seeds dark, with metallic luster, tuberculate.

In western New Mexico, at the copper mines, *C. Wright*, 874, coll. 1851; *Coues* and *Palmer*, Fort Whipple, northern Arizona, 1865; found by myself 1880, on rocky banks in the Santa Rita Mountains, southern Arizona.

Very near *P. pilosa*, with which I had formerly united it; the seeds of both are similar, their tubercles, magnified 40–60 diameters, appear very prettily as overlapping excrescences with a toothed free edge; both have dark seeds, ours with a metallic luster, the others more dull. The number of stamens in different flowers was about 40; while in *P. pilosa* it is stated to be 15 to 25, but in cultivated specimens of the latter I have found as many as 50! The color and size of the flower, the larger leaves with sparing hair in the axils, and the stouter stems and perennial (?) rootstock distinguish it from its purple flowered annual relative.

ROSA SPITHAMEA, Watson, Fl. Cal., 2, 444.—In the deep shade of the Big Trees of Fresno county, Cal., where scarcely anything else grows, I found what I take to be a form of this pretty little species, blooming in September. I may designate it as

Var. SUBINERMIS: Stems a span high, glabrous or more or less glandular hispid, with a few scattered setaceous spines (none stipular) or spineless; stipules short and narrow with short narrow divaricate free points; leaflets mostly 5, thin, pale below, elliptical or nearly orbicular, obtuse, sharply serrate and glandular serrulate; rhachis glandular-pubescent and often spinulose, petiolule of terminal leaflet almost its own length; flowers single (1¼ to 1½ inches wide) rose colored; peduncle slightly glandular, calyx tube globose, naked, lobes entire.

The stems of the same season bear the flowers, as is the case in *R. foliolosa* of Texas; or is it in this instance an autumnal form? There may be characters enough, especially the absence of any stipular spines, to distinguish specifically this southern form from the northern type, but considering the great variability of roses it is thought best to keep them together for the present.

The western roses and, to some extent, all our roses are in some confusion and what my cursory visit to the Pacific coast may have done to clear them up is offered here.

Rosa Nutkana, Presl, is common in Oregon and northward, but I have not met with it in California; it is characterized by very broad and stout stipular and cauline spines, which are particularly abundant on annual shoots, and by large single flowers and large globose or depressed fruit. *R. Durandii*, Crepin, from Oregon, appears to be a form of this species with glandular calyx tube, which in the species is glabrous.

Rosa pisiformis, Gray, stands next to this and not to the following. Like it, it has well developed stipular spines, but they are slender and more terete; corymbs few-flowered, fruit smaller; young shoots mostly densely covered with dark red brown slender spines and spiny bristles, by which the plant can be distinguished any time, even without flower or fruit. I found it from British Columbia down to the neighborhood of San Francisco and Monterey.

Rosa Californica, Cham. & Schl., a bush often 4–5 feet high, along streams, bears its flowers in large compound corymbs; its annual shoots are glaucous, covered with stout straight or often curved or even hooked glaucous spines; form of fruit variable, oblong or globose, with a more or less distinct contracted neck.—Common about San Francisco, thence northward to the Klamath River and southward to Los Angeles and San Bernardino.

Rosa gymnocarpa, Nutt., in the rich woods of the Oregon Coast Ranges with stems 1½–2 inches thick and 8 feet high, otherwise mostly a slender bush; annual shoots densely covered with glaucous or gray bristly spines; distinguished from all other roses, I believe, by its naked fruit (globose or elongated, sometimes pointed at both ends), from which after flowering the *united* calyx lobes separate, bearing at their base the stamens.

Campanula scabrella, n. sp.—Several leafy stems from a stout rootstock, a few inches high, 1 to several-flowered, the whole plant canescently-scabrous with very short rough pubescence; lower tufted leaves spatulate, obtuse, attenuated below, stem leaves sessile, lanceolate, acutish; flowers erect, lance-linear lobes of calyx as long as tube; ovate-lanceolate lobes of corolla as long as its tube, scabrous outside; style shorter than corolla; capsule erect, oblong, 10-angled, opening near the upper edge.

On bleak rocky ridges of Scott Mountain, west of Mount Shasta, under scattered trees of *Pinus albicaulis* and *P. Balfouriana* with *Anemone Drummondii*, Wats.,* *Veronica alpina*, *Polygonum Davisiæ* and the charming *Epilobium obcordatum*, in August. The thick tap-root penetrates 3 to 5 inches between the fragments of rock; lower leaves 1

*Well distinguished from *A. multifida* not only by its larger fruit and long style, but also by the oval, not circular, outline of the more finely divided leaves, the terminal division of which is long stiped, not sessile.

inch long, the upper not much shorter; branches strictly erect, peduncles naked, flowers nearly ½ inch long.

Distinguished from the closely allied *C. uniflora* by the habit, the cane cence and the form of the capsule. Careful study of abundant materials proves that *C. uniflora* will have to comprise all the forms from Colorado and Utah which have been named *C. Langsdorffiana* or *C. Scheuchzeri*, among them the specimens of Parry and of Hall with denticulate calyx lobes and similar ones gathered by myself; they have erect elongated capsules tapering below, opening near the top; corolla divided nearly to the middle, often 1 inch wide; stems 3 to 4 or 8 to 10 inches high, 1 to 4 flowered. True *C. Scheuchzeri* (or *linifolia*) comes from Alaska; its corolla lobes are short, ⅓ or less of the tube, the short ovate capsule is nodding and opens at base. The confusion arose in great part from the carelessness of collectors, who are mostly satisfied with nice flowers and neglect the less conspicuous fruiting specimens. Among several dozen specimens from the Rocky Mountains and Alaska, gathered by different collectors, I find only few with the characteristic capsules, and these I collected myself. Fruit and seed are such important organs that they ought always to be hunted up, and of every plant; this necessity is well known in *Compositæ* and *Umbelliferæ* but it is true of all plants and ought to be well borne in mind by collectors. Such neglect is one of the causes why the species of *Vitis* and especially the *Cactaceæ* were not better understood long ago.

A Double Epigæa repens.—A good many years ago, I think in 1867, my brother, Prof. L. W. Bailey, of Fredericton, N. B., sent me a note which I read before the Boston Society of Natural History, on a double *Epigæa repens*, found near his home. To-day Miss Sarah L. Mann, of Central Falls, R. I., communicates a specimen, found, she writes, among some flowers from Massachusetts. The precise locality is not given. The nearly sessile umbel presents seven blossoms all of which show increase of parts. The calyx exhibits no aberration, but is succeeded by three perfectly gamopetalous corollas, each within the other as in the familiar cases of doubling in *Datura* and like plants. In the changes the stamens have entirely disappeared, or are perhaps represented only by certain aborted, hood-like appendages to one or more of the lobes of the inner whorl. The pistil appears to be normal. In some of the flowers there are rudimentary filaments. The real, as well as the pseudo-corollas are provided with the usual pubescence, and are normal as to color and fragrance. It would be interesting to know whether this plant maintains itself as a perennial form, as in the case cited by my brother. I will add that the rosettes are extremely pretty, though to a botanist's eyes teratological developments are always a little obtrusive.—W. Whitman Bailey, *Brown University*.

Artemisia annua, L.—This thrifty weed which has for a number of years been cultivated for ornament under the name of

"Sweet Scented Fern" threatens to become more abundant than desirable. In some localities in the southern part of this state, in patches, it appears to be the principal growth. It delights in broken ground and rich, sandy soil, but its accommodative powers appear to be great. I have observed it growing, uncultivated, in the counties of Wabash, Lawrence, Edwards and White, and I am informed by good authority that in the counties farther south it is becoming quite common. It being an annual will probably prevent it from becoming a very serious injury or annoyance to agriculture.

As this species is not described in any of our text books I will give the following description and notes on it, based on those given in the old German work referred to in the article on *Chenopodium album* and *viride* (BOT. GAZ., Vol. VI, p. 225): From three to six feet high, branching, ends of the branches and branchlets drooping, outline of whole plant pyramidal, clusters of flowers roundish and pendant, peduncles one-fourth inch long. Leaves tripinnately dissected, ovate lanceolate in outline, two to six inches long; whole plant smooth or very minutely pubescent. The whole plant gives off a strong, but not unpleasant odor, which partakes of that of *Artemisia Absinthium* and camphor. Root annual and yellow. This species is a native of Siberia. According to J. G. Gmelin the inhabitants of Jenisea boil this annual Artemisia with their mead to give it a pleasant odor (flavor?). S. G. Gmelin also reports, in his "Voyage through Russia," that this species of Artemisia is used in the tanning of the well known *Saffian* leather (Turkish morocco). He further remarks that a coloring matter is obtained from this plant named *Tschagan*, four pounds of which will color twenty-five goat skins. In this dye the skins are steeped, by the addition of one pound of finely pulverized cochineal, some honey and salt, the red color is obtained. To produce the yellow *Saffian* leather, another dye, called *Kuk* is added; in this latter case however, the honey and salt are omitted.—J. SCHNECK, *Mt. Carmel, Ill.*

New Species of Fungi, by Chas. H. Peck.—UROMYCES PSORALEÆ.—Spots none or indistinct; sori epiphyllous, scattered or crowded, sometimes occupying the whole upper surface of the leaf, blackish-brown; spores elliptical, obovate or pyriform, obtuse, granular within, 0008–.0012 of an inch long, .0008–.0009 of an inch broad, the pedicel short, colorless.

Living leaves of *Psoralea lanceolata* Utah. August. *Jones.*

The lower surface of the leaves in the specimens before me is occupied by *Æcidium Psoraleæ* which is probably the hymeniferous form of this fungus.

UROMYCES ZYGADENI.—Spots pale or yellowish, sometimes confluent; *hymeniferous fungus* with the peridia amphigenous, short, scattered or crowded, the spores subglobose, orange, .0008–.00095 of an inch broad, with a thin hyaline epispore; *teleutosporous fungus* with the sori amphigenous, clustered, small, blackish-brown, sometimes intermingled with the *Æcidium*; sporesobovate or subpyriform,

obtuse .0011–.0013 of an inch long, .0008–.0009 of an inch broad, the pedicel shorter than the spore.

Living leaves of *Zygadenus paniculatus*. Utah. June. *Jones*.

Professor Jones observes that this fungus destroys the leaves it attacks.

ÆCIDIUM SARCOBATI.—Spots merely a thickened portion of the matrix; peridia elongated, cylindrical, crenate lacerate at the apex, orange colored; spores subglobose, .0008–.0009 of an inch in diameter.

Living leaves of *Sarcobatus vermiculatus*. Utah. June. *Jones*.

The bright orange-colored elongated peridia make this a showy species. The cells of the peridia are pentangular or occasionally hexangular and contain highly colored oil globules. The spores in the dried specimens are whitish, but they may have been more highly colored in the fresh state.

SYNCHYTRIUM JONESII.—Tubercles rather large, unequal, prominent or somewhat depressed, hypophyllous, reddish-brown, the epidermis at length rupturing irregularly; spores globose, smooth, reddish brown, .0003–.0004 of an inch in diameter.

Living leaves of *Zauschneria Californica*. Bingham. Utah. Also on leaves of *Vicia Americana* in company with *Æcidium porosum*. Near Ogden, Utah. July.

In the color of the spores this species does not strictly agree with the generic character, but in other respects it is so good a Synchytrium that I have thought it best to refer the fungus to that genus. The species is dedicated to its discoverer, *Prof. M. E. Jones*.

NOTE.—Since the publication, in THE BOTANICAL GAZETTE, Vol. IV, p. 170, of the description of *Bovista spinulosa*, I have received, from Dr. J. J. Brown of Wisconsin, a mature specimen which shows that the peridium ruptures in a stellate manner and that therefore the fungus should be referred to the genus Mycenastrum. The description needs the following revision:

MYCENASTRUM SPINULOSUM.—Peridium globose, sessile, two to four inches in diameter, thick, firm, whitish, becoming tinged above with yellow and brown and externally cracking into rather large areas, the whole brown when mature and stellately splitting from above into six or seven unequal spreading or reflexed rays; capillitium and spores in the mass dark-brown with a slight purplish tinge; flocci rather short, pale, usually branched, armed with scattered unequal aculei which are more numerous near the acuminate extremities; spores globose; colored, minutely warted, .0004–.0005 of an inch in diameter.

The species may be distinguished from *M. Chilense*, to which it is allied, by its paler and globose peridium and by its larger and globose spores.

I have also received from Mr. C. G. Pringle of Vermont, fresh specimens of the fungus described in Vol. V, p. 35, under the name *Peziza spongiosa*. These show by their texture that the fungus should be referred to the genus Bulgaria, with the following description:

BULGARIA SPONGIOSA.—Cups large, one inch or more broad, concave or infundibuliform, becoming nearly plane, thin, soft, subgelatinous, externally blackish, hymenium blackish-brown, often becoming porous when old; stem one-half to one inch long, slender, black, rugose or longitudinally wrinkled; asci cylindrical; spores uniseriate, globose, smooth, granular within and sometimes uninucleate, .0005 of an inch in diameter; paraphyses filiform, colored, circinate or uncinate-curved at the tips.

Buried sticks under fir trees.

The Evolution of the Cryptogams.—Upon this subject the latest writing is from the pens of MM. Saporta and Marion. In two numbers of *Nature* the work is reviewed by J. Starkie Gardner. A second volume is to follow dealing with the evolution of Phanerogams. Of course the group Cryptogams has long been recognized to be a purely artificial one, but not quite so meaningless as its old subdivisions. The origin of all animals and plants is protoplasm and when we find this in an amorphous condition and yet possessing the attributes of life we cannot be far wrong in thinking that such forms are most nearly like the primordial ones. In certain other organisms this protoplasm secretes about itself a wall and presently chlorophyll is differentiated and we have all the essentials of a vegetative life. Thus are we led from the *Protista* to *Protophytes* and particularly to the *Algæ*. *Fungi* and *Lichens* are considered as groups whose development has been arrested by a parasitic habit and to *Algæ* must we look for an explanation of the manner in which aquatic vegetation became terrestrial. The more highly organized forms have always retained their aquatic habit, and it is from the lower *Algæ* that terrestial forms have originated. The authors think that "some, with flat cellular fronds, such as *Ulva*, crept, as it is supposed, face to the ground and became ancestors of the *Hepaticæ*. Others, more confervoid, produced a thallus whose growth, necessarily apical, became complex by simple vegetative multiplication. Foliary appendicles were given off, and a sort of plantlet with rootlets, stem, and leaves, all strictly cellular, came into existence, capable, like the Mosses at the present day, of agamous reproduction. In the earliest stage of growth of the *Equisetaceæ*, of Ferns, and of *Ophioglosseæ*, we see a similar primordial cellular plant, called a Prothallus, develop from the spore, and resembling in every respect the lower *Algæ*."

The authors lay a great deal of stress upon the effect of the reproductive act upon the differentiation of primordial plants. Two widely different groups would be developed by "tardy" reproduction and by "precocious" reproduction. In low forms reproduction arrests nutritive life. Hence forms like the Mosses and *Hepaticæ* in which the reproduction is tardy, would have a long period of vegetative life in which to adapt themselves to new conditions. In fact some mosses seem very little dependent upon sexual reproduction but can propagate themselves rapidly by their radicles. The "fruit" of the moss is really a distinct plantlet which in an asexual way gives

rise to spores and these spores in turn produce new vegetative plants. This comparatively short phase in the life history of the moss which we call its fruit, or more properly "sporogone," becomes the principal part of the life of plants with precocious reproduction, such as Ferns, Equisetaceæ and Ophioglosseæ. In these cases the prothallus at once gives rise to male and female organs, and the resulting "sporogone" by its vigorous growth soon destroys all traces of the early sexual phase. This primitive thallus becomes more and more subordinated as we advance in the plant kingdom, becoming of less relative size and more and more transient. As we advance the sexes begin to be separated and the way in which this might have been accomplished is very ingeniously presented. First the spores themselves become sexual and we have microspores and macrospores and here the prothallus nearly disappears and with it "almost the last trace of the primordial cellular Alga." We would thus have both a male and a female prothallus.

At last in Phanerogams the microspore or pollen grain produces the "pollen tube" as the representative of a male prothallus; while the macrospore or embryo sac gives rise to the female prothallus, which we call "endosperm."

The whole subject is one of exceeding interest and importance and we now begin to know enough to know that our old ideas of the relations of plants hardly deserve even the epithet "crude" and that immense fields of investigation are opening before us the extent of which no man dares to measure.—J. M. C.

How Cross-Fertilization is Aided in Some Cruciferæ.—In some *Cruciferæ* the introrse anthers of the long stamens become extrorse before the pollen is shed. In the opening buds of *Brassica campestris* and *Cardamine paucisecta* the anthers of one pair of stamens —slightly surpassing the stigma—exactly face those of the opposite pair; but while the flower is expanding and before the pollen is discharged the anthers of each pair by quarter twists of the filaments—one to the right, the other to the left—are made to face in opposite directions, thus virtually becoming extrorse. Moreover, the anthers bend downward, making it still more difficult for any wind shaking to bring pollen in contact with the stigma. The anthers of the short stamens remain introrse since, the stigma being out of their reach, they can do no harm.—Volney Rattan, *San Francisco, Cal.*

Sarracenia purpurea, L.—On June 8th while collecting a few specimens of *Sarracenia purpurea*, L., I was surprised on drawing aside the petals to look at the stamens, to see the whole cavity formed by the petals and the peltate expansion of the style filled with flies as large as the common house-fly, all busy as could be eating the pollen, of which scarcely a grain could be seen. I counted fourteen flies in one flower. They were in no hurry to vacate the premises. There was a shower coming up at the time, but they were evidently there for food. Nearly every plant examined was filled in the same way.—Joseph Jackson, Jr., *Millbury, Mass.*

Carex aurea, Nutt.—I have specimens of *Carex aurea*, Nutt., found growing in the moist, sandy soil just back of the lake beach. They fruit very abundantly and many of the spikes are decompound which on examination proves to be due to the proliferation of secondary spikes from the lower perigynia. In most cases this is shown by a tumidity of the base of the peduncle but in others (when the spikelets are small) the mother perigynium is quite well developed and occasionally one perigynium is superposed upon another. An interesting theory of the mode of development of the spikes of *Carices* might be based upon these sports.—J. J. Davis, *Racine, Wis.*

Cypripedium candidum.—Dr. Gray says that this plant grows in bogs. *C. pubescens* and *spectabile* are found here in damp woods and I have searched in similar localities, for years, for *candidum*, without success. Yesterday I discovered a fine lot growing on the driest kind of a rocky hill.—E. W. Holway, *Decorah, Iowa.*

Development of Heat in Flowers of Phytelephas.—It has long been an admitted fact that many plants at their season of flowering exhibit appreciable elevations of temperature: Lamarck, rather more than a century ago, was, I believe, the first to notice the phenomenon. As the few books I have had the time or opportunity of thus far consulting contain no mention of the behavior of the Ivory Palm (*Phytelephas macrocarpa*), I now write to put briefly on record two or three observations respecting that plant. A fine example (female) was recently in flower in the House No. 1 at Kew. On April 20th, at 1 p. m., the temperature of this house was 68° Fahr.; the bulb of the thermometer, which had been suspended for some time near the plant in question, was placed in the center of the cream-colored inflorescence, and the mercury almost instantly rose to 92°, showing an increase in temperature of 24°. It is probably fair to assume that the normal temperature of a plant like the *Phytelephas* with such a large surface for evaporation, &c., is considerably lower than that of the surrounding air; in any case the actual increase in temperature is remarkable. The following day, at the same hour, the thermometer registered 72° degrees in the house, and, when placed in the same position in the center of the inflorescence, only rose to the same height as that reached the preceding day, viz. 92°. As the drawn-out end of the bulb prevented it from actually touching the convex ovaries, a small incision was made in one of these, and the thermometer then rose to 94°. Within the last week *Philodendron sagittifolium*, with its anthers nearly ready to dehisce, showed a rise from 69° to 81°, and *P. eximium*, at a time when by sun heat the house had risen to 82°, exhibited a further increase of 10°. *Carludovica Plumieri* rose from 73° to 90°, but this last was certainly not in good condition, for the long barren stamens had already changed from creamy-white to cinnamon color, and the spathe had commenced to decompose, although not three hours had elapsed since the flowers had opened.—George Nicholson, *in Trimen's Journal.*

Botanical Gazette.

Vol. VI. AUGUST, 1881. No. 8.

Editorial.—The Editor of this journal will be absent during the month of August. This announcement is not to discourage correspondence, but to account for any delay in answering it. All communications can be sent as heretofore, and contributions to the September number must be in hand on or before August 25.

The pellucid stems of *Pilea pumila* yield as rich and easy results to the microscopic anatomist as any plant I know of, hardly excepting the universally useful pumpkin vine. The stems are already translucent and when hardened by alcohol are remarkably easy to get perfectly transparent sections from. The single row of epidermal cells, the frequent section views of stomata, the typical collenchyma and under it the cambium, and then about a dozen perfectly top-shaped fibro-vascular bundles, all come out so clearly that even a beginner can demonstrate them with but little difficulty. My pickle jar is full of it now and a glimpse of one or two sieve plates has encouraged me to look farther. I mention all this because so universally abundant a thing as *Pilea* can easily be "pickled" for fall and winter use in the laboratory.

Mr. A. H. Curtiss, of Jacksonville, Fla., has his second fascicle of Southern Ferns ready for distribution, and also a second issue of the first fascicle mostly collected in different localities. The second fascicle is mailed to subscribers for $1.50; the first for $1.25; 25 cents off on extra sets in one package.

The new fascicle contains *Pteris longifolia*, *P. Cretica*, *P. serrulata*, *P. aquilina*, var. from Cape Sable, *Adiantum Capillus-Veneris*, *Asplenium parvulum*, *A. dentatum*, *A. firmum*, *A. myriophyllum*, *Aspidium trifoliatum*, *Ancimia adiantifolia*. All of these are root specimens.

The reissue of the first fascicle contains *Acrostichum aureum*, *Polypodium aureum*, *Blechnum serrulatum* and *Aspidium unitum*, var. *glabrum* from the Caloosahatchie; *Polypodium pectinatum*, from Daytona; *Polypodium Phyllitidis* and *Vittaria lineata* from forests bordering the Everglades; *Aspidium patens* and *Nephrolepis exaltata* from near Tampa; *Cheilanthes microphylla* and *Aspidium Floridanum* from the St. John's River.

Prof. A. F. W. Schimper, of Johns Hopkins University, in the July *Naturalist* gives a brief account of the results of his recent investigations upon the growth of starch grains. The theory of Nageli has been generally accepted and intussusception has been taught in our class rooms with considerable confidence. The investigations of Prof. Schimper, however, reveal certain facts which can by no means be

reconciled with the prevailing theory. In the first place it is found that the middle part of starch grains is first formed and the outer parts deposited around it. This is proved from the fact that the corroded surface of young grains is seen within older ones, covered up by subsequent deposits. The main strength of Nageli's theory, however, lies in the fact of the appearance in the starch grains of alternating layers of more and less watery substance, giving the appearance of concentric lines about the nucleus; also that young grains by no means resemble the center of old ones, for the latter are very watery and the former very dense; also that growth in different directions is unequal; and the growth of compound grains is strongest between the nuclei, whereas growth by apposition would be greater at the periphery. Prof. Schimper thinks that these appearances do not necessarily prove growth by intussusception, but can be explained by certain properties of starch grains. These properties are stated as follows: "(1) Starch grains are rather brittle parallel to the layers, but very extensible perpendicularly to them. (2) Cutting, crushing or extension causes the dense starch substance to swell up considerably and to take all the properties of the more watery parts of intact grains. (3) Swelling up in water is much stronger parallel to the layers than perpendicularly to them." Nageli recognizes tension, but thinks it due to the intercalation of starch molecules being greater in one direction than another. Prof. Schimper says the tension is due simply to the unequal swelling in different directions and that the starch substance would be extended, not broken, and hence would become more watery and less refractive. Therefore wherever the tension is greatest the less watery substance will appear more watery. The tension would naturally be greatest at the central part of the grain and the middle part of the layers.

The unequal growth of starch grains is explained by the unequal conveyance of material. Starch grains have central nuclei whenever they are completely imbedded in chlorophyll granules. When they are formed at the edge of these granules they become eccentric. The formation of compound grains is thought to be due to the growing together of free granules and not to division of simple grains, as Nageli holds.

Lilium Grayi.—I think not more than half a dozen plants of this species have so far been found. Mr. Watson regards it as a good species. Dr. Gray, in a letter to the writer, believes it will not be found specifically distinct from *L. Canadense*. On Roan Mountain last year the writer saw a plant from which the flower had been eaten by a cow, while on the stage ascending the mountain, but on returning next day could not find it again. Subsequently Prof. Porter found one in fruit, kindly dividing it, the living root to the writer, and the top for his herbarium. This root, having been dug up before mature, had but a single instead of two flowers as last year, but afforded a chance for continuous observation. The perianth is so short and broad that the first impression is that of a *Fritillaria*. If *Lilium Canadense* was not

known to vary, one might regard it as distinct species, but I have what I call "broods" of this species from different parts of the country, and as they all flowered one after another, I had to conclude *L. Grayi* to be but one of them. It does not belong to the erect flowering species as believed by Mr. Watson, but droops till the flower begins to fade, just as *L. Canadense* does. It is interesting however as being the first of my "broods" to flower. It was open about the first of June. The New Jersey brood was not open till ten days after, and a very beautiful and brightly colored brood from Mississippi not till twenty days after *L. Grayi*.

By the way, this matter of comparative flowering often leads to erroneous conclusions. Two kinds may, under equal circumstances, have one flower a few days after the other, but it may be that as one is about to go out of flower the weather becomes cool and cloudy and the slightly late one is retarded. What would have been days becomes weeks of difference.

Again my "Mississippi brood" were all raised by offsets from one original bulb, and have so far all opened about the same day. But this year one bulb took a notion to flower four days before any of the others, all growing beside it. It teaches that variations from supposed normal types must not always be necessarily from seeds. "Bud variations," as Dr. Masters calls them, are also potent in originating distinct characters.—THOMAS MEEHAN.

A New Station for Lysimachia thyrsiflora, L.—May 17, 1881, while on a plant-hunting tour among some small ponds within out city limits, I was so lucky as to find *Lysimachia thyrsiflora*, L., and in bloom. It grew along the border of a small pond, among sedges. On consulting our manuals, I find all give this species a more northern habitat than this; and in Mr. H. N. Patterson's catalogue of Illinois plants it is reported from "Cass Co. and northward," while in the catalogue of Indiana plants, published by the editors of the GAZETTE and Prof. C. R. Barnes, it is credited from "Marion and Lake;" either of these localities is more than one hundred miles northward. There were a goodly number of plants, and all appeared as if among their natural surroundings and doing well. The pond is one of a series into which the Wabash river flows during times of high water. May it not be that by the aid of the annual freshets this northerner is gradually working its way southward, as *Carex retrorsa*, Schw., also appears to have done?—J. SCHNECK, *Mt. Carmel, Ill.*

Marine Algæ of New England and Adjacent Coasts, by W. G. Farlow, M. D. (Reprinted from report of U. S. Fish Commission for 1879).—This report of Professor Farlow occupies 210 pages, to which are added 15 plates, illustrating the types of structure and fructification. The genera and species are all very carefully described, the range indicated, the localities of the rarer kinds mentioned, and often some critical or interesting note added. The author has distributed the Marine Algæ into four orders, *Cryptophyceæ*, *Zoosporeæ*,

Oosporeæ and *Florideæ*. The first order contains the simplest forms, such as *Clathrocystis*, which Dr. Farlow has proved to be the cause of the red color of some of the codfish cured at Gloucester, and the *Nostochineæ*, which are arranged after Thuret. The second order includes all the grass-green algæ except *Vaucheria*, and with them are also placed the *Phæosporeæ*, which suborder includes *Laminaria*, *Agarum* and *Alaria* as well as several tribes of less conspicuous olive-brown algæ. The third order is made up of the *Vaucherieæ* and *Fucaceæ*; and the fourth is very nearly coincident with Harvey's *Rhodospermeæ*. This system embraces all that is good in the arrangement proposed by Cohn, and gives moreover a definite place to some families which that author knew not how to dispose of. The parallelism to Oosporic, Zygosporic, Carposporic, etc., Fungi is not dwelt upon, nor even mentioned. It is to be hoped that future studies may separate the *Vaucherieæ* from the *Fucaceæ*, as they are widely different in structure, habit and color, and even the mode of producing oospores is not very similar in the two groups. Then the *Fucaceæ* could take rank as an order, which would be more befitting their general character. As there has been no thorough revision of the New England Algæ since the publication of the Nereis, nearly thirty years ago, a good many minor changes are introduced, and corrections made. The number of additional species is considerable, but with the exception of a *Fucus* or two, a *Laminaria*, a new *Nemastoma*, several *Corallinaceæ*, a *Dityosiphon* and four species of *Monostroma*, they are mostly minute or obscure forms, which would escape the notice of a less practised algologist than Professor Farlow. An introduction of twenty-four pages gives the reasons for the classification adopted, and contains many hints which will be very useful to the collector and the student. The latter will find at the end of the book an excellent "Artificial Key to the Genera," and a good list of the works consulted in the preparation of the report. Altogether the work is thorough and scholarly; it reflects high credit on the author, and it will be of very great use to students of these interesting and beautiful plants.—

D. C. Eaton.

Aquilegia chrysantha.—Every botanist knows that a label will sometimes get misplaced, especially in the sometime hurry of collecting, and that error will creep in at times in spite of the best efforts at accuracy. It was only in view of these well known chances that I suggested in Vol. IV, No. 1, that there might be some mistake about the plant which Mr. Marcus E. Jones found at Colorado Springs, which had the flowers of *A. cærulea* and of *A. chrysantha* all on one. My chief reason for making the suggestion was that I had made some careful collections in that vicinity in 1871 and in 1873, and many good botanists had also collected there, and it seemed that so large and so showy a plant should have been readily seen by some one. As Mr. Jones subsequently wrote that he could not be mistaken, there would seem to be no need of any further record in the matter. I would however like to do him the justice to say that a correspondent sends me

specimens from Cheyenne Canon, five miles below Colorado Springs, and has also found a few specimens in Glen Eyrie. She also reports that it is said to be abundant in Bear Creek Canon. It is still I think remarkable that this plant was not collected by any of the early explorers of this district, and it is probable that it is one of those cases where the appearance of man changes circumstances in favor of the rapid spread of plants which had little show in the unaided struggle for life in wild nature.

I may further remark that the width of the flowers sent me by my correspondent favors Mr. Jones' suggestion that *Aquilegia chrysantha* and *A. cærulea* are not specifically distinct.—THOMAS MEEHAN.

NOTE.—Since I sent you my note on the yellow *Aquilegia* at Colorado Springs, my correspondent writes that she has found two cases of pale blue flowers on the same plants as the yellow ones. I am glad to render this additional testimony to the accuracy of Mr. Jones' observations. The flowers however seem to be yellow forms of *Aquilegia cærulea*, and not to have the short sepals and petals in comparison with the spurs, which *A. chrysantha* has.—T. M.

Hieracium aurantium.—This foreign plant is not described in our botanical text books, and I judge is not generally known in this country. It is quite common here and is fast becoming a troublesome weed.—W. H. LENNON, *Brockport, N. Y.*

Aplectrum hyemale.—Among a large number of specimens of this plant, collected a few weeks ago, at least one third had flowers of a *greenish-yellow*, without the slighest trace of brown or purple, not even a speck on the lip. Is this variation common? The botanies do not mention it.—W. H. L.

Some New York Ferns.—At the village of Holley, about twenty miles west of Rochester, N. Y., the Rochester and Niagara Falls R. R. crosses a ravine up which, within a distance of less than two miles, are found the following ferns:

Polypodium vulgare, *Adiantum pedatum*, *Asplenium Trichomanes*, *A. ebeneum*, *A. angustifolium*, *A. thelypteroides*, *A. Filix-fœmina*, *Camptosorus rhizophyllus*, *Phegopteris hexagonoptera*, *P. Dryopteris*, *Aspidium Noveboracense*, *A. Thelypteris*, *A. cristatum*, *A. cristatum*, var. *Clintonianum*, *A. Goldianum*, *A. marginale*, *A. spinulosum*, *A. acrostichoides*, *Cystopteris fragilis*, *C. bulbifera*, *Onoclea sensibilis*, *O. Struthiopteris*, *Dicksonia pilosiuscula*, *Osmunda regalis*, *O. Claytoniana*, *O. cinnamomea*, *Botrychium ternatum*, *B. Virginianum*, *B. matricariaefolium*, *B. lanceolatum*.—W. H. L.

Botanical Handbooks For Tourists.—An excellent list of this kind has been published by Prof. G. L. Goodale in No. 9 of the Bibliographical Contributions from the Library of Harvard University. We print it here as we have so often received letters asking just the

information this list gives so satisfactorily and this one answer will serve for many inquirers. The list is meant to comprise simply the most useful works for the determination of the flowering plants of the regions specified.

UNITED STATES.—NORTH.—Manual of the Botany of the Northern United States, including the district east of the Mississippi and north of North Carolina and Tennessee, arranged according to the natural system. By Asa Gray, New York. 8vo.

SOUTH.—Flora of the Southern United States; containing abridged descriptions of the flowering plants and ferns of Tennessee, North and South Carolina, Georgia, Alabama, Mississippi, and Florida, arranged according to the natural system. By A. W. Chapman, M.D. The Ferns by Daniel C. Eaton. New York. 8vo.

The two following works contain descriptions of the plants growing east of the barren western plains, both North and South. In the second the descriptions are much abridged:

Class Book of Botany. By Alphonso Wood. New York. 8vo.

American Botanist and Florist. By Alphonso Wood. New York. small 8vo.

WEST.—*Colorado.*—Synopsis of the Flora of Colorado. By Thos. C. Porter and John M. Coulter. Washington. 8vo. (Miscellaneous Publications, No. 4, of Professor Hayden's Geological and Geographical Surveys of the Territories.)

Utah and Nevada.—United States Geological Exploration of the Fortieth Parallel. Clarence King, Geologist in charge. Botany by Sereno Watson, aided by Professor D. C. Eaton and others. Washington. 4to.

California.—Botany. Vol. I. Polypetalæ, by W. H. Brewer and Sereno Watson. Gamopetalæ, by Asa Gray. Cambridge 4to. (Uniform with the publications of the Geological Survey of California.)

Vol. II. Apetalæ, Vascular Cryptogams and Mosses. By Sereno Watson and others.

THE BRITISH ISLANDS.—Manual of British Botany. By Chas. C. Babbington, F. L. S. London. small 8vo.

Handbook of the British Flora: a description of the flowering plants and ferns indigenous to, or naturalized in the British Isles. For the use of beginners and amateurs. By George Bentham, F. L. S. London. 8vo.

The Student's Flora of the British Islands. By Sir J. D. Hooker, Director of the Royal Gardens, Kew. London. small 8vo.

FRANCE—Flore des Environs de Paris. By Casson and Germain de Saint-Pierre. Paris. 8vo.

SWITZERLAND.—Flore analytique de la Suisse. Vademecum du botaniste. By P. Morthier. Paris and Neuchatel. 12mo.

GERMANY.—Synopsis floræ germanicæ et helveticæ, exhibens stirpes phanerogamas et vasculares, cryptogamas rite cognitas, quæ in Germania, Helvetia, Borussia et Istria sponte crescunt atque in hominum usum copiosius coluntur: (auctore D. Guil. Dan. Jos. Koch). Leipzig. 8vo. Also published in the German language.

ITALY.—Prodromo della flora Toscana, di Teodoro Caruel. Florence. 8vo.

THE EAST—Flora orientalis sive Enumeratio plantarum in oriente a Graecia et Aegypto ad Indiae fines hucusque observatarum auctore Edmund Boissier. Basle. 8vo. The parts already published extend through the order *Borraginaceæ*.

The Internal Hairs of Nymphæa and Nuphar.—In the *American Monthly Microscopical Journal* for June and July, Mr. Chas. F. Cox, F. R. M. S., gives a very interesting paper on the "Epidermal Organs of Plants." In taking up the physiological portion of the subject he considers that stomata are not only of use in evaporation, but are directly connected with the assimilative process, while hairs are connected with metastasis. From his discussion of internal hairs we make the following extract:

If we examine with the microscope a section of the leaf, or the petiole, of a plant from either of these genera (*Nymphæa* and *Nuphar*), we are at once struck by certain abundant, thickened, branching, unicellular structures scattered through the parenchyma and projecting into the intercellular spaces. These structures have long attracted the attention of microscopists, but not until recently have they been distinctly recognized as internal hairs. The standard text-books of the microscope, such as Carpenter's and the Micrographic Dictionary refer rather doubtfully to the resemblance between these bodies and the stellate external hairs of *Deutzia* and *Alyssum*, but they generally shyly avoid calling them plainly internal hairs. Some writers speak of them as "stellate parenchymal cells;" and on a purchased slide which I own, they are described as "stellate raphides." But out of the confusion and uncertainity which has prevailed with regard to these structures, there has gradually crystallized a clear and definite recognition of the fact that they really are epidermal organs, exactly analogous to the external hairs of terrestrial plants, such as we have been considering.

In the first place, the mere morphology of these structures confirms the idea of their being truly hairs. In their outlines they so closely resemble some of the external hairs with which we are familiar (for instance those of the genus *Arabis*), that their analogy is at once suggested to the observer. They seem, however, to be always unicellular growths, and transverse sections show them to be hollow. Over their surfaces are scattered the grains of silex, so characteristic of other hairs, and made particularly familiar to us by the hairs of the Deutzias. If one wishes a striking demonstration of the mere resemblance of these internal hairs to better known external hairs, he has only to split the petiole of *Nuphar* or *Nymphæa* by tearing, and view it with the binocular as an opaque object. This, of itself, will be convincing to most persons acquainted with the peculiarities of leaf hairs.

But, aside from configuration and other merely morphological considerations, the mode of distribution of these internal hairs is almost precisely like that of external hairs. If we take a thin section

of a leaf of *Nymphæa*, cut parallel to its surface, and examine it as a transparent object (still better if we illuminate it with polarized light) we shall see that these internal hairs, like external ones, are associated with the fibrovascular system; and toward the margin of the leaf, where the tissues are thin and the veins small, we shall find that the hairs exist only upon the veins and not between them. This is quite in accordance with what we know of the habit of all hairs, as I have already explained.

If we take a transverse section of the leaf of *Nymphæa* or *Nuphar*, cut across the midrib, we shall be struck by another fact connecting these internal hairs with the epidermal system. We shall at once notice that from the upper side of the leaf—which is, under common circumstances, the only side exposed to the air, and is consequently the only side possessing a true epidermis—these hairs spring like stumps of trees in an inverted field. From end to end of the section they will be observed planted close together, their pedicels imbedded in or forming a part of the epidermal layer, and their branches spreading downward and inward through the underlying parenchymal tissue. This is very marked in stained sections, in which the hairs take a darker color than the surrounding tissues; but in an unstained section, polarized light differentiates the structures quite as well as the elaborate, double staining process now so commonly employed. It is to be noted that this arrangement of the hairs is confined to the upper or epidermal side of the leaf, and that no similar arrangement is to be seen at any other part. The distribution of the hairs on the interior of the petiole of the water plants is somewhat different from their arrangement on the interior of the leaf, but it is closely analogous to the arrangement of hairs upon the exterior of the petiole of land-plants.

I have referred to the fact that these internal hairs are good objects upon which to use polarized light; and this is a point of no small importance in the argument for their being actually hairs. To any one acquainted with the behavior of vegetable tissues with the polariscope, particularly of vegetable hairs, the manner in which these internal structures of the *Nymphæaceæ* are affected by polarized light is strong confirmation of their claim to be regarded as epidermal organs and true hairs. The way in which they take different colors in the process of double staining, will be another affirmative argument with those familiar with that process and its effects. Suffice it to say in this connection, that these internal hairs behave in precisely the way, and take exactly the colors, that external hairs do.

That structures physiologically referable to the epidermal system should be found growing in the midst of the parenchymal system, is not altogether anomalous, for sections of the leaf and petal of *Magnolia grandiflora* reveal an abundance of thickened, irregular, unicellular structures scattered through the parenchyma, which, both in their appearance and in their mode of distribution, at once suggest some sort of similarity to the internal hairs of *Nymphæa* and *Nuphar*; but which, in my judgment, are parts of the glandular system of the Mag-

nolia. Indeed, any true sunken gland my be regarded as an internal epidermal organ.

Plants which do not live either entirely in the water or entirely out of it may naturally be expected to occupy, so far as their oganization is concerned, a position intermediate between submerged plants and aerial plants. Such is the case with the Nymphæaceæ. While not relinquishing their dependence upon, and their connection with, the external atmosphere, they nevertheless provide against partial submergence, by an increase of their capacity for internal interchange of the gases necessary for their life and growth. In other words the amount of external surface exposed to the atmosphere being largely curtailed, by reason of their partial submergence, this loss is compensated for by a great increase in the amount of internal surface exposed to the air and gases contained in the intercellular spaces. By this enlargement of the intercellular spaces the inside of the plant becomes (if I may be allowed the paradox) to some extent, for physiological purposes, another outside; and the practical effect is the same as if there were less intercellular space, and more surface exposed to the outer atmosphere. To the same extent as the inside becomes practically a part of the outside, by reason of its exposure to surrounding air and gases, that part of the outside which is submerged becomes practically part of the inside, by reason of its exposure to the surrounding fluid.

In plants existing under such peculiar circumstances, we need not be surprised to find organs and tissues, which in strictly terrestrial plants are external, becoming internal. And so there is no *a priori* reason against the existence of internal hairs, or even of a whole internal epidermal system, in the Nymphæaceæ. But we have no warrant for looking for internal hairs in all partially submerged, or wholly aquatic, plants any more than we have for expecting to find external hairs upon all terrestrial or aerial plants. As a matter of fact hairs do not exist upon many land plants which seem to grow under the same circumstances and surroundings as others upon which hairs are found; and so, while *Nymphæa* and *Nuphar* are internally pubescent, *Nelubium* and *Brasenia* are internally glabrous. It is no easier to account for this difference in land-plants than it is in water-plants; but in both cases it is doubtless caused by some fundamental, physiological difference at present unknown.

That the great enlargement of the intercellular spaces in submerged, or partly submerged plants is for the purpose of facilitating the internal interchange of gases which, in plants, growing upon the land, would take place externally, is no new theory of my own. Sachs, in his "Botanical Text-Book," says:

"A submerged water-plant, for example, which contains chlorophyll, absorbs carbon dioxide from without, under the influence of sunlight; and at least a portion of the disengaged oxygen collects in the cavities. When it becomes dark this process ceases; the collected oxygen is now absorbed by the fluids of the tissues, and gradually transformed into carbon dioxide, which can again diffuse back into

the cavities, but partially also through the layers of tissue into the surrounding water."

In the light of these facts we can perceive how the interior of a water-plant may become of more importance to it than the exterior, for most physiological purposes, and under the circumstances it is not strange that we find such important organs of the metastatic process as the hairs, transferred from the exterior to the interior, where the amount of surface exposed to the interchanging gases is many times greater than that exposed to the external atmosphere.

Treeless Prairies.—Mr. Thomas Meehan remarked that the absence of timber or arborescent growth on the grassy prairies of America still continued to be a matter of controversy, but he believed that in the light of accumulating evidence, we might now come to a positive decision in regard to the question. The most prevalent belief had been that trees would not grow on these prairies,—and we have had theories relating to soil or climate, to show why they could not grow. Then there were others who believed that trees did grow there in ancient times, but had been burnt off and kept burnt off by annual fires.

Mr. Meehan considered in detail the authors who had propounded various theories, and the distinguished men who had advocated them, and said that it was evident climate could have nothing to do with the question, because in these prairie regions there were often large belts of timber lands, projected like huge arms into the grassy regions, with precisely the same climatal conditions over both. That the soil was not unfavorable, was proved now by the artificial plantations everywhere successful, and that the soil was unfavorable to the germination of tree seed, as suggested by Prof. Whitney, was on the face of it untenable from the fact that it required but the same conditions for the seeds of trees as for those of herbaceous plants, the number of species of which on the prairies was well known to be very large. Another great gain to our present knowledge was that since the annual firing of the grassy prairies had been discontinued by the advance of civilization, the timber was everywhere encroaching on them. Among the facts which he offered in proof of this, was a reference to p. 505 of the 7th Report of the Geological Survey of Indiana, where Dr. Schneck shows how land which was once grassy prairie, is now covered with a luxuriant growth of forest trees; to the evidence of Major Hotchkiss, Geologist of Staunton, Virginia, that the Shenandoah Valley, now heavily timbered, was clear of trees in the early history of Virginia; to the discovery of buffalo bones, in caves near Stroudsburg, Pa., by Dr. Joseph Leidy,—now a timbered region, the buffalo only existing in open, grassy countries;* and to various traditions of settlers in some valleys now timbered, that the land was once clear of trees. He pointed out that in all known parts of the United States at the present time, except the arid regions,

*Since the reading of the paper, it has been brought to the attention of the author, that the bones may have belonged to the Wood Buffalo.

where only drought-loving plants could exist, the natural result of freedom was the succession of forest growth. Seeds were scattered by winds or animals over acres of cleared land; if such land became neglected, these, again seeding in time, extended the forest area continually. The tallest growing vegetation, like trees, crowded out the weaker, and the forest naturally crowded out the lower growing and weaker herbaceous plants. He illustrated this by reference to the neglected cotton-fields of the Southern States.

From all this, the speaker said that it was evident that there was nothing in Nature either now or in the past, to prevent the gradual encroachment of the forest over the grassy plains, till long before the white man came here, the whole would have been completely covered by arborescent growth, Were there any artificial causes equal to the exclusion of trees, and yet permitting an herbaceous growth? If we were to sow a piece of land in the autumn wtih some tree seed and some seeds of annuals, the latter would be up, flower, mature and scatter their seed to the ground before the next autumn, and many of these seeds would be washed into the earth, or drawn into the earth by insects or small animals. But tree seed would make young trees, which would not again produce seed for ten or more years. If now, at the end of this first season, a fire swept over the tract, the seeds of the annuals which had found a slight earthy protection, would come up again the next summer, again seeding and extending the area. The trees would be burned down, and though perhaps many would sprout, successive burnings would keep them confined to one place. In short, under annual burnings, herbaceous plants could still increase their area annually, but trees could never get far beyond the line they had reached when the annual fire first commenced. There could be no doubt that an annual burning in a tract destitute of forest growth, would certainly prevent the spread of timber, or of any plant that required more than a year to mature seed from the time of sowing. Now, if we look at the actual facts, we find that the Indians did annually fire the prairies.

Father Hennepin, the earliest writer on Indian habits, noted that it was the practice in his time. There is but little doubt but this practice of annual burning has been one extending long into the past. What object had they in these annual burnings? They must have known that the buffalo and other animals on which they were largely dependent for a living, throve only on huge, grassy plains, and that it was to their interest to preserve these plains by every means in their power. Low as their power of reasoning may be, they could not but have perceived that while grassy herbage throve in spite of fires, perhaps improved under the fiery ordeal, trees could not follow on burned land. What could be more natural than that they would burn the prairies with the object of retaining food for their wild animals? If we have no difficulty in reaching a positive conclusion so far, we may now take a glance at the early geological times. Mr. Mechan then referred to the researches of Worthen, Whittlesley and others in Ohio, Illinois and other prairie regions. On the retreat of the great glacier, the higher

lands and drift formations were probably high and dry long before the immense lakes formed from the melting and turbid waters ceasedto be.

It was tolerably well understood that many species of trees and other plants which required a temperate atmosphere, retreated southwardly with the advance of the glacier, and advanced to higher latitudes on the glacier's retreat.. Thus these higher ridges would become timbered long before the lower lands became dry. Evidence accumulates that man existed on this continent, in the far west, not long after the glacier retreated, though "not long," in a geological sense may mean many hundreds of years. The lakes of glacial water would gradually become shallower from the deposit of the highly comminuted material brought down from higher land, from the wearing away of rocky breastworks as in South Pass, Ill.. as well as from the openings which would continually occur from nature's ever varying plan of streams under ground. In all events, the drying of these lakes would be from their outward edges first. Aquatics would give way to marsh grasses, and these to vegetation such as we now find generally spread over the prairie region. If now we can conceive of human beings such as we know the Indian races to be, already in more southern latitudes—having learned the fact that firing would keep down trees and aid in the preservation of the chase—following the retreat of the glacier to the higher lands, and still as they advanced northwardly, firing the plains up to the water's edge, it would certainly account for the absence of arboreal vegetation from these immense lacustrine lands from the very beginning of their formation. Of course with thisview we should have to look for some evidences of man's existence, both on the lands which were once under water, as well as those whichwere timber lands at his first appearance there. He did not know how many such evidences have been or may be found. Man's traces in the past are at best but rare, and they would naturally be much more scarce in the lacustrine regions than in lands dry at the same epoch. At any rate, this part of his remarks he said, must be taken as mere speculation; but as we could see on the basis of sound scientific investigation why there could be no trees on these grassy prairies within the range of indubitable history, it was a fair inference that some such cause had continued from the beginning; namely, that annual fires had ever been the reason why arborescent vegetation had never had an existence there.—*Proc. Phil. Acad.*

Catalogue of Michigan Plants.—This catalogue of 105 pages is the work of Chas. F. Wheeler and Erwin F. Smith of Hubbardston, Mich. There could not well be a finer state botanically, than Michigan. Cut up as it is into two peninsulas, with its diversified conditions, it seems rich in rare plants. The catalogue is confined to Phanerogams and Vascular Cryptogams, and numbers 1,634 species. It contains a colored map of the state and a preface describing the general botanical features. The price is fifty cents and the authors well deserve some acknowledgement of their laborious work.

Botanical Gazette.

Vol. VI. SEPTEMBER, 1881. No. 9.

Editorial.—Dr. Asa Gray will return to this country during the first weeks of September. He is heartily welcomed home by all botanists, few of whom have not reason to thank him for repeated favors.

Dr. Geo. L. Goodale has earned a year's relief from class work. He sailed September 3 for Germany where he will try to find much needed rest. The burden of a popular professorship, an extensive botanical garden, and other university duties is heavy enough at best; but add to all this repeated sickness at home and it will tax the strength of the strongest.

Erratum. In Mr. Lennon's article on page 248 of the last Gazette, *Hieracium aurantium* should read *H. aurantiacum*.

Dr. Fritz Muller has discovered in Brazil two kinds of stamens of different function in the same flower. The plant is a species of *Heeria* (*Melastomaceæ*) and the two sets of stamens are distinguished by short filaments with yellow anthers, and long filaments with red anthers, the color of the petals. The parts are so arranged that an insect plundering the conspicuous yellow anthers will have its body well dusted with the pollen of the other set.

M. Storbzl assures us that the slow immersion of a fresh plant in a boiling solution of one part of salicylic acid in 600 parts of alcohol, and then shaking off superfluous moisture, previous to pressing in the usual way between blotting paper, will more nearly preserve the natural color than any other method.

Mr. H. W. Ravenel in the August *Torrey Bulletin* describes the peculiar habit observed in *Asclepias amplexicaulis*. It is a case of apparently one-ranked leaves, caused by the stems assuming a recumbent position and twisting alternately from right to left and from left to right. In this way both surfaces of the leaf are exposed alike to the sun.

Mr. W. H. Leggett in the September number of the same periodical has a most interesting note on the "Fertilization of *Rhexia Virginica*." The minute pore found in the anthers has often been thought of insufficient capacity to provide an escape for the pollen. Mr. Leggett finds that the inflated sacks at the base of the anthers act as bellows and that when a bee treads upon them they yield to the pres-

sure and force through the minute pore a jet of pollen "directly upon the rear or side of the intruder." He states that in experimenting a surprising quantity of pollen was thrown by touching the "bellows" with a blunt point.

PROF. C. E. BESSEY is making the Botanical Department of the *American Naturalist* more valuable than it has been for years. It is kept abreast with the times and botanists get hints of all that is doing in the botanical world.

THE AMERICAN MICROSCOPICAL JOURNAL for August contains a useful list of preservative solutions for botanical preparations. It is taken from *Brebissonia*, reprinted there from an opuscle published in 1872 by Messrs. Cornu, Gronland and Rivet. In the same number a few filterings of Croton water in August are shown to yield 24 species of Algæ, not to mention numerous Diatoms

MR. J. G. BAKER has begun a synopsis of the genus *Pitcairnia* in the *Journal of Botany* for August. This is one of the largest genera of *Bromeliaceæ*, numbering now seventy species. In this first number a key to the species is given and eighteen of them described.

DR. GRAY gives in the last *American Journal of Science* a review of the third volume of DeCandolle's *Monographiæ Phaenogamarum*. This volume contains over 1000 pages and is mostly devoted to the two orders *Commelinaceæ* and *Cucurbitaceæ*. The former is by C. B. Clarke; the latter is the work of Cogniaux, of Belgium. The order *Commelinaceæ* contains 307 known species, arranged under 26 genera. The order is chiefly tropical, finding its most northern limits in the Northern United States or British America. Two thirds of the large volume is devoted to *Cucurbitaceæ*, an order which had been elaborated for the Prodromus by Seringe over fifty years ago. Since that time the material has increased tenfold, and of the 600 species M. Cogniaux describes 219, and has seen all but eight! Dr. Gray remarks: "The geographical distribution of a family at once so peculiar, so wide-spread and so considerable in numbers and generic diversity (79 genera and 600 species), might raise interesting speculations. It must be an ancient family; for the numerous genera, as well as the species, are circumscribed in range, and only six or seven are common to the Old and New World, except as diffused under human agency."

PROF. W. J. BEAL sets his students all to work, and the results of their observations form no mean contribution to botanical science. The latest we have noted are recorded in Meehan's *Gardener's Monthly* for September. Three students have been trying to answer the question, "Will red clover not visited by bees produce seeds?" The results of the experiments given seem to show that when guarded from bees the heads sometimes set seed, but always in very much diminished quantity.

Chapmannia and Garberia.—There is nothing more difficul than to describe a plant so that a person who has never seen it may

form a correct conception of its appearance. The characteristic *aspect* of a plant can only be described by comparison. The best of dried specimens fail to show all. That subtile quality which corresponds to expression is often wholly lost. This quality is sometimes of varietal importance, and its loss in drying often renders apparent a relationship difficult to perceive in the living plants. Detailed descriptions or field notes relative to most southern plants would hardly be admissable to the pages of the GAZETTE, but there are two plants with which I am sure its readers will be glad to be made better acquainted, because of their association, by name, with two of our most zealous botanists, namely, Dr. A. W. Chapman and Dr. A. P. Garber. This association appears the more fitting when we consider that these two plants are strictly Floridian, and that the botanists whose names they bear have distinguished themselves most by their labor s in Florida.

The *Chapmannia Floridana* and *Garberia fruticosa* are confined not only to Florida but to the center of that State. This range, however, is not nearly so limited as has been supposed. Dr. Chapman described both as growing in eastern Florida. In the course of my travels I have found *Chapmannia* in abundance from Fort Ogden, in Manatee Co., to Ocala, in Marion Co., a distance of 150 miles. *Garberia* I have found on the western coast at Tampa, on the eastern coast near Matanzas, and in the interior near the Ocklawaha. *Garberia* grows only on "spruce-pine ridges," dry "heavy" sands, which make the worst of roads, and best suit that peculiar pine which Dr. Chapman has named *Pinus clausa*.

The *Chapmannia* grows in dry, open woods, and flowers through out May, June and July. Its flowers are showy, but few and ephemeral, otherwise the plant is uninteresting except to the botanist, who finds in it some very noticeable peculiarities. It is a slender plant, sparsely branched, with meager foliage, in habit much like *Desmodium rigidum*. Like most other *Leguminosæ* found in these pine woods, the roots bear slender tubers a few inches below the surface. The stems —one or more from a root—are slender, leafy below, above more or less branched and glandular-hirsute, the calices being quite viscid. The leaves are pubescent beneath, 1′–2′ long, pinnately 3–7 foliolate, and are provided with subulate persistent stipules. The leaflets vary from one-fourth of an inch to nearly one inch in length; they are mostly obovate or oval and obtuse, but they vary from orbicular to narrowly lanceolate, and from acute to retuse, always mucronate and petiolulate. So far we find no marked peculiarities. Let us now proceed to the inflorescence, where generic characters are to be looked for, and note such features as are not mentioned in Chapman's description. That author does injustice to the flowers of his plant; instead of being "small," the perfect flowers are quite large, often an inch and a half in width. Their color is a deep rich yellow, like those of *Stylosanthes*. They open early in the morning, perhaps in the night, and in sunny weather are closed by nine o'clock, scarcely outlasting the dew. As the keel is closely wrapped around the stamens, the flower appears to be tripetalous, the other three large petals spread-

ing in a plane, or being reflexed as in *Cyclamen*. The apparent peduncles are about an inch in length, but these are really peduncle-like branches or the axes of 1–3 flowered racemes, the pedicels being only a line in length, bracted at the base, thickening under the fertile flowers into top-shaped receptacles. When there is more than one flower the terminal one is sterile, the lower and fertile flowers consisting of a pistil only. The legume is somewhat moniliform and consists of from one to four joints, each about one-fourth of an inch long, hispid, the terminal one beaked. The joints disarticulate as readily as do those of *Tripsacum*, the articulations being tumid and oblique, the scars oval and white.

As to the *Garberia* I cannot add much to the published descriptions. It is a shrubby Composite, of cinereous color, unique among cis-Mississippi plants, but similar to some of the shrubby *Compositæ* of the far west. It grows on sterile, sandy ridges, where it forms compact bushes two to four feet in height, with numerous stems and branches, its mode of branching being Ericaceous, like *Azalea*, etc. It is quite leafy, the leaves being obovate and only about an inch in length. The corymbose flowers appear in the fall and are of a dull purple color. It is singular that Nuttall should have called this plant a *Liatris*. Many botanists have considered that great similarity of floral structure is unquestionable evidence of generic identity, and this opinion has led to some very artificial grouping of species. Prof. Gray did well in separating *Liatris fruticosa* from the rest of that genus. It was also highly proper to take out the species *odoratissima* and *paniculata*, but the propriety of erecting a new genus for them is questionable. Familiarity with these plants in the field leads me to believe that their natural position is in the genus *Carphephorus*, to species of which each is closely allied. Only a slight change of generic characters would have been required to establish this very natural group.

—A. H. CURTISS.

Botanical Notes, from Rev. E. J. Hill, Englewood, Illinois.—*Anemone multifida*, DC. Found in flower August 10, 1878, on the sandy beach of Grand Traverse Bay, near the landing at Torch Lake, Mich. A number of specimens were gathered in various states of flower and fruit, showing that it had not ceased blooming since the time it began to flower in early summer.

Cadramine hirsuta, L., var. *sylvatica*. The smooth form, like the original *C. Virginica* described by Michaux, grows in dry, open woods at Highland Park, north of Chicago. It is usually found farther south.

Lepidium campestre, L. Adventive by Ft. Wayne R. R., at Englewood. Only a few plants found.

Hibiscus Moscheutos, L. This plant, with a large and showy flower, grows luxuriantly by Lake George, and in the adjacent swamps near Whiting, Lake county, Indiana. The plants were often five feet or more in height, and the flowers larger than those of the common Hollyhock. I saw it in cultivation at Bear Lake, Manistee county, Mich., in August, 1880. It was brought by emigrants from Ohio. As the land was comparatively dry, and the height of the plants three

feet or more, with flowers large and well formed, the evidence was conclusive that it easily bears cultivation. I learned that the stock from which this was brought was also cultivated.

Hippuris vulgaris, L. Grows in a small stream at Otis, Ind., ten miles west of Laporte. It is the only place where I have seen this plant, comparatively rare, in this vicinity. I do not often meet with it elsewhere, the only time, as I have it recorded, in Bear River, near Petoskey, Mich., and at Frankfort, Mich., both stations on the eastern shore of Lake Michigan.

Cornus Canadensis, L. As in the case of some other species of *Cornus*, this was found both in flower and fruit at Manistee, Mich., August 6, 1880.

Erigeron bellidifolium, Muhl. Specimens with white flowers were found last year at Whiting, Ind. Also those with pale pink rays varying to white. Nearly all the flowers seen the present season are white.

Diplopappus umbeliatus, Torr. & Gr. Plants roughish and pubescent occur at Whiting. Similar forms were found this year at Sault Ste. Marie. Those thickly covered with hair were obtained at Bruce Mine, on the St. Mary River, Ontario.

Bidens Beckii, Torr. This plant, credited in Gray's Manual (and on the same authority in Patterson's Catalogue of Illinois Plants) to Illinois, but without locality, grows in the Calumet River at South Chicago. Occurs also at Manistee, Mich.

Cnicus Pitcheri, Torr. Grows on the sandy shore of Lake Michigan, at Pine Station, Ind. Also found in similar places at Petoskey, Mich. In both places it is associated with *Solidago Virgaaurea.*, L., var. *humilis*, Gray.

Veronica Anagallis, L. Plants glandular hairy (Gray's Syn. Fl. N. A.) are found at South Chicago.

Sparganium minimum, Bauhin. In ponds at Manistee and in "sloughs" at Pine Station. These are the only localities where I have seen this plant during many years of collecting, and it is not abundant in either place.

Potamogeton Claytoni, Tuck. In creeks of Pere Marquette River, Ludington, Mich., forms occur with floating leaves 1½′–3½′ long, and the submersed leaves 7-nerved.

Potamogeton perfoliatus, L. I find typical forms of this in the Little Manistee River, at Manistee, with short, roundish or oval leaves. Nearly all the plants gathered at the West have the lanceolate leaf, usually shorter than in the type specimen (var. *lanceolatus*, Robbins.). They gradually vary with all degrees of difference between the variety and the typical species, so that it is often hard to tell to which they should be assigned.

Potamogeton Niagarensis? Robbins. This plant, probably only a variety of *P. pauciflorus*, Pursh, has been found common in several places near here the past season. I have traced it as far east as Otis, Ind.

Mr. C. F. Wheeler, of Hubbardston, Mich., sends it from his vicinity. Its fruiting season is long. It was gathered with well formed fruit May 28, and found fresh and in fruit as late as September 6.

Potamogeton pauciflorus, Pursh. Typical forms are found at Manistee and Frankfort. These have fine, almost hair-like leaves. I have not yet met with these here, as all the plants seem to have the type of fruit of *P. Niagarensis*, and the leaves broader, with a larger and coarser growth of stem. Both forms usually grow in dense masses, often completely covering or even filling the water if very shallow, the stems being so entangled as to be separated with difficulty. I found none of the form of *P. Niagarensis*, last summer, on the eastern shore of Lake Michigan, between Frankfort and Ludington, unless some broader leaved specimens, growing with *P. pauciflorus*, but without fruit, be of this kind. Those seen this summer at Sault Ste. Marie, and on the east side of St. Mary's River, in Ontario, and at Mackinac have the fine leaf.

Potamogeton pusillus, L., var. *major*, Fries. This plant, hitherto considered very rare and hard to get, grows in great abundance at Manistee, in the lake and river of that name, and in the Aux Becs Scies, at Frankfort. In both these places it was the prevailing form so far as observed. In 1878, while making the "inland passage" between Cheboygan and Petoskey, Mich:, a few plants were picked out of Crooked River, but under conditions that did not allow of a determination of its abundance. The evidence is in favor of its being common in the northern part of the southern peninsula of Michigan. This conjecture, made on the evidence of last year's examination of localities in Michigan, has been strengthened by the experience of this summer. All plants of *P. pusillus* seen in the St. Mary's River, at Sault Ste. Marie, were of the var. *major*. Perhaps it is essentially a northern form. It may be looked for in other places east of Lake Michigan, within the limits of that State, and in Wisconsin and northward. Until the present season I had marked it as "rare at South Chicago," having found a few specimens. This season I have found it in fair quantity at this place, thus, in all probability, indicating the range of the plant as co-extensive with Lake Michigan. Near Chicago the forms of *P. pusillus* incline to the var. *tenuissimus*, Mertens & Koch, typical specimens of the plants being hard to find.

Potamogeton marinus, L. This was gathered in Crystal Lake, east of Frankfort. It grows in sand in the shallow water by the margin of the lake. The stems rise from running rootstocks to the height of two to six inches. The stigma is not sessile, but with a short style, differing in this from the type species. Mr. Wheeler sent the same plant for identification, the habitat of which was unfortunately lost To make the determination of the Crystal Lake specimens certain they were sent to Mr. Morong, of Ashland, Mass., and the only difference noticed is the presence of the short style. In the specimens sent by Mr. Wheeler the stigma is more nearly sessile. Since writing the

above I have found plenty of the typical form, like those gathered by Rev. Morong "in shallow rapids at Streets Island above Niagara Falls," mentioned in the BOTANICAL GAZETTE for May, 1880. They grow in the rapids of St. Mary's River. Those found were on the American side, near the head of the rapids. The water is shallow and the bottom thickly covered with pebbles and stones, among which they root. A few were seen above the rapids.

Potamogeton (undetermined). This plant, mentioned in the BOTANICAL GAZETTE of May, 1880, as occuring at Ashtabula, Ohio, and thought to be a variety of *P. zosteræfolius*, Schum., was again found the past season at Manistee. As it grew in abundance, opportunity was given to study it in all stages of growth. The plants gathered at Ashtabula were too few and imperfect to determine with definiteness. It will apparently have to rank as a new species unless identified with some European form. It grows in stagnant water, in the four places where it has yet been seen, in pools or ponds without an outlet. These are common in Michigan, being "kettle-holes" made in the boulder clay of the drift formation. Sunk many feet beneath the rim of surrounding hills, they furnish a fine soil in their slimy bottoms for the growth of aquatic plants.

Broad leaved forms of another *Potamogeton*, allied to *P. pectinatus*, also occur at Manistee and Frankfort. At the time of finding, in August, the fruit was barely formed, too immature for determination. It must ripen in September or October. Apparently the same species was detected in the St. Mary's River the present year. Mr. Morong thinks it may be *P. flabellatus*, Babington, a species found in Europe. The attention of collectors is called to this, that those who may have an opportunity to gather it later in the year may secure some with ripened fruit. It may be looked for in situations in which *P. pectinatus* grows, though on the whole it seems to prefer more rapid water. In the St. Mary's River the current was so strong as to bow the stems, three or four feet long, into a nearly horizontal direction. Some were seen growing in the same condition in the Little Manistee. The broader leaves, the stem pinnately rather than dichotomously branched, and the late fruit, are good external distinctions, between it and *P. pectinatus*. I have found the fruit of the latter well formed as early as June 20. All forms of *P. pectinatus* found at Manistee and Ludington had all the fruit ripe and plants decaying.

It may be added incidentally that the study of these *Potamogetons* furnished good examples of the principle of "compensation in growth." When the leaves of *P. pusillus*, var. *major*, *P. pauciflorus*, and of the last mentioned kind were particularly remarkable for breadth, they were quite uniformly devoid of fruit. They seem to have exhausted their forces in the production of leaves.

Goodyera Menziesii, Lind. Sparingly found at Frankfort. Other stations are Petoskey and Boyne Falls, Northport and along Grand Traverse Bay, Mackinac. Common at Sault Ste. Marie, on the Canada side. Resembles *Goodyera pubescens*, the common form at all

these stations, but it is generally taller and with the leaves striped rather than blotched with white. *Goodyera repens* appears to be uncommon in these localities.

Spiranthes Romanzoviana, Chamisso. Found in bogs at Northport, Mich., by a pond known as Mud Lake. Rather common at Sault Ste. Marie. It closely resembles, externally, *S. cernua*, and might easily be taken for that plant, but generally has broader leaves and blossoms earlier, in July and August.

Listera convallarioides, Hook. Cedar swamps, Bear Lake, Mich., Sault Ste. Marie, Ontario.

Juncus pelocarpus, E. Meyer. Bear Lake, also at Laporte, Ind.

Rhynchospora capillacea, Torr., var. *leviseta*, E. J. Hill. This plant, first detected at Pine Station, Ind., in 1875, and described in the *American Naturalist* the following year, is distinguished from the typical species by its perfectly smooth bristles. It has been observed in the original locality nearly every year since, and preserves the same peculiarity. Last year it was gathered in abundance at Whiting, and found the present season at Edgemoor, between the two stations mentioned above. So far as observed, plants from these three places, and from different localities surrounding them, all have the characteristic smooth bristles. I have not found any other form near Chicago. In 1878 a few plants of the variety were discovered growing with the typical species at Torch Lake, Mich. Having observed it in four different places, and for several years, the variety may be regarded as constant, and be distinguished as above.

Fimbristylis autumnalis, Roem. & Schult. At Whiting. Nut pale yellow, prominently covered with stipitate tubercles or wart-like projections. Torrey, in his "Cyperaceae" under *Trichelostylis mucronulatus*, mentions these tubercles, and Chapman, in his "Flora of the Southern States." Grows in abundance in moist sands.

Hemicarpha subsquarrosa, Nees, var. *Drummondii*, Gray. At Millers, Ind.

Carex Emmonsii, Dew. A variety with the bracts considerably longer than the culm. At Whiting.

Triticum violaceum, Hornemann. Not uncommon at Whiting.

Selaginella selaginoides, Link. Mackinac, in springs above the cliff known as the "Lover's Leap." In Wheeler and Smith's Catalogue only credited to Isle Royal.

Selaginella rupestris, Spring. Grows on sand hills at Millers, at Manistee, and near Traverse City. Associated at Millers and Manistee with *Hudsonia tomentosa*. The little plant is often nearly buried in the shifting sands.

Lechea Novæ-Caesareæ, C. F. Austin. In open sandy woods, near Tolleston, Lake Co., Ind. Having found, last September, what I took to be this plant, specimens were sent to Wm. H. Leggett, of New York, who makes a specialty of this genus, and the determination was sustained.

Goodyera pubescens.—During the summer of 1880, desiring to get a flowering specimen of the above named plant to press, I visited the well-known locations hereabouts throughout the season, but was unable to find a solitary plant in flower, nor do I think any of the plants in this neighborhood flowered. The previous year there were the usual number of flowering plants, and so there are this year. It would be interesting to know if this is a common occurrence or the result of an accident.—JOSEPH MEEHAN, *Germantown, Phila.*

"Our Native Ferns."—This is the title of a very neat and handy volume by Lucien M. Underwood, of the Wesleyan University, Bloomington, Illinois.

The author has adopted the plan of Gray's Lessons and Manual for his work, dividing it into two parts, the first being devoted to a brief study of the habits, structure and classification of ferns, with appropriate sections on germination, fructification and the identification of species, and the second part to a systematic description of genera and species arranged in accordance with an original synoptical key.

As will readily be seen, the plan is an excellent one, and has been well carried out by the author, who is not only deserving of great credit, but the thanks of all fern students as well.

The sections of the first part are well calculated to introduce a beginner to the study of the interesting plants of which the author has himself been so appreciative a student, and contain scarcely anything for adverse criticism. It is, however, to be regretted that the term "*rhizoma*" should have been used in so broad and general a sense as to include all kinds of rootstocks. The term has a more restricted meaning to which it should be limited, merely standing for one kind of a rootstock, just as a caudex does for another kind.

If one general term is to be used it is better to adopt that of "rootstock" in accordance with the excellent practice of Prof. Eaton in Ferns of N. Am., a work, by the way, with which Mr. Faxon's name ought to have been associated in the chapter on "Fern Literature." The artificial synopsis is an excellent one, that will prove to be of much service to amateurs in identifying specimens, and, so far as examined, the descriptions are concise and clear.

The illustrations, although not of a very high order, assist the explanations in the text, which throughout is clearly written. The two glossaries of technical terms at the end might as well have been combined in one, and it may be in place in connection with them to state that *Aspidium Boottii* was named for Wm. Boott, who discovered it, and not Dr. Francis. The author's views in general are conservative, and his book, which is to be commended, will no doubt serve the purpose for which it was intended admirably.—GEO. E. DAVENPORT.

Nasturtium lacustre.—I found this plant in a little pond near Lincoln, Ill. It had been flowering for some time, and as the racemes grew longer, the plant seemed to sink lower and lower into the water. Some had a few leaves still above the water, but most of them had ev-

en a part of the racemes immersed, so that only the flowering portion was visible. The pods were therefore kept under water, and I rarely found one to have ripened seeds and I doubt whether these would have germinated. As the pods were slightly inflated I concluded that they served to hold the still flowering portion above water. If the pods ripen but rarely the plant must have other means of propagation since it spreads rapidly. And these it has, for it was found to spread abundantly by means of branches from the base of the stems trailing along the bottom of the pond and striking roots as they grow. About the flowering season, the much divided immersed leaves break off from the stem. Just above their bases a small branch appears. The base of the parent leaf curves downwards into the water, so that the branches as they grow larger are enabled to float on the water, by bending away from the parent leaf so that the midrib of the parent leaf and the stem of the branch are in the same line. While still small the roots appear at the base of of the stem and run up the curved base of the parent leaf for a distance of one-fourth inch from the base; in this manner they are sometimes above water but still appearing to be in good health. Here my observations ceased. Whether these rootlets derive nutriment from the parent leaves, if they continue to grow until they reach the tip of the leaves, I know not. But in a month they had all become attached to the bottom of the pond. Still it seems probable that as the base of the stem becomes too heavy to float it sinks into the water, the heavy parent leaves begin to rot and hang vertically and so direct the roots into the soil, at the same time affording nutriment, which it as yet does not obtain from the ground. — AUG. F. FOERSTE, *Dayton, Ohio.*

Hieracium aurantiacum, L.—*Hieracium aurantiacum* (not *aurantium*, as printed at p. 248.) I have had sent to me several times from correspondents in the Eastern States during the past twenty years, and sometimes from stations which suggested that this plant may possibly be indigenous. It would be well, before the plant becomes too common for the purpose, to note the surroundings, so as to judge of the mode of introduction if possible. Miss Mary S. Cope, of the Ladies' Botany Club of Germantown, collected fine specimens on the Catskills in July of this year. A native of Siberia, according to Gmelin, there is no reason why it may not be indigenous in some of our higher mountains, the chief objection to this view being its apparent rapid spread of late years. A plant of its character would, in all probability, have been more widely distributed if truly indigenous. Still I think it would be well to have a note of all the stations and conditions under which they grow.—THOMAS MEEHAN.

Albinism.—White flowers of species normally blue or red are comparatively common. It does not seem to be on record that colored flowers ever come from those normally white. The white varieties of colored species, when under culture, continue to reproduce white flowers, at least I never knew one to revert till now. I enclose the specimen *Wahlenbergia grandiflora*. One single blue flower has come

out from the stalk which bore all others white. I have also one plant from the white seed which so far has produced blue flowers. It establishes the fact that an albino can revert to its normal color.—
THOMAS MEEHAN.

Rootstocks of Convolvulus sepium.—In a recent visit to Fredericton, N. B., my brother, Prof. L. W. Bailey, of the University of New Brunswick, called my attention to the peculiar rootstock of *Convolvulus sepium*. The Indians of the Melicete tribe had, he said, shown these to him on the islands in the river, as articles of food. They are long and moniliform, the expanded, tuberous portions being quite round and hard, and the whole root being several feet in length. Upon consulting descriptions of the plant at hand, I find no allusion to these rootstocks being moniliform. They would seem to be quite characteristic.—W. W. BAILEY, *Brown University, Providence, R. I.*

Nymphæa odorata.—We learn from our text-books that the flowers of *Nymphæa* open in the day, and after fertilization are drawn under water by the contraction of the peduncle, where the fruit ripens. But of the means of dissemination furnished by nature to the seed, they say nothing.

Mr. R. H. Warder, son of Dr. John A. Warder, has a number of fine specimens of various species, *N. alba*, *N. odorata*, *N. tuberosa*, (?) &c., growing in an artificial pond on his father's place, near North Bend, Ohio. He has observed that numbers of seedling plants are coming up around the margin of the pond, and was for a time at a loss to know how the seeds strayed away from the neighborhood of the parent plant, if they were ripened under water and planted themselves on the the bottom, for the seed, as he knew, is of a greater specific gravity than water , and there was no current in the pond, and the water is never agitated so as to disturb the sediment. While gathering flowers he observed floating on the water, something resembling frog-spittle. A quantity was collected, placed in a vessel, and upon examination proved to be seeds of *Nymphæa* enveloped by the membranaceous aril, as described by the authors. This sac though open at the top still contains enough air to float the seed for some time, and thus by favoring winds or currents, it may be transported to some distance from the parent. A number of specimens kindly brought to the writer by Mr. Warder, remained afloat in a bottle, after being roughly handled in transportation, for abouttwenty-four hours, when they escaped from the membranaceous envelope, through its partial decay probably, and sank to the bottom, the sacs still floating. There being little chance, as Dr. Warder says, for a new plant to establish itself among the mass of roots of a *Nymphæa* bed, this means for the transportation of the seed to a favorable locality, will account partly for the wide distribution of the genus. Winds and currents would carry them to a distance while still contained in the sac, and when that buoy has lost its buoyancy, or through its decay, the seed drops in a favorable place, and a new plant will be estab-

lished. The specimens producing the seeds described are, the writer thinks, a variety of *N. odorata*, contrary to the opinion of Mr. Warder, who inclines to think them *N. tuberosa*. The flowers are large for *N. odorata*, less odorous, and the leaves of some of them are raised above the water's surface like the older leaves of *Nelumbium*, but the seeds are oblong, and raised on a stipe within the arillus which is much longer than the seed; while in *N. tuberosa* the arillus is shorter, the seed round and not stipitate.

These observations have been mostly made by Dr. Warder and his son, by whose request they are placed on record by

DAVIS L. JAMES.

Scales of Thuja gigantea 3-ovuled—I have long known that the scales of *Thuja gigantea*, Nutt., were three-ovuled and usually three-seeded, but do not see it noted in any of the books I have examined. The seeds are imbricate, that is, the wings of the two outside ones overlap the inner one. I see no difference in the wings, both sides being alike in all I have examined.

The genus *Thuja* as laid down in the botany of California will have to be amended to include this species as it grows in this vicinity.

Another thing I have not seen noted; it annually sheds, not only its leaves, but its branchlets. These turn yellow in the fall and drop off in a few weeks.—THOMAS HOWELL, *Sauvies Island, Oregon.*

Plants of North-Western Australia, enumerated by Baron Ferdinand von Mueller.—This folio pamphlet of twenty pages comes from a strange country with a list of still stranger plants. The north-western part of Australia had never been explored botanically before 1861, at which time about 120 species were recorded. The present list is made from a collection of Mr. John Forrest while engaged in a trigonometrical survey of the Nickol Bay District during the year 1878. "Among the plants given as of more than ordinary interest are the real Caper-plant (*Capparis spinosa*), not specifically distinct from the Mediterranean typical plant; the Strychnia-bush (*Strychnos nux-vomica*); the ordinary Haricot Bean (*Phaseolus vulgaris*); *Hibiscus Goldsworthii* a highly ornamental shrub; *Eremophila Fraseri*, a bush of showy splendor; the *Decazesia* (a new genus of *Compositæ*), an elegant everlasting, the glorious Marie Palm (*Livistona Mariæ*), the only palm as yet known from the west coast of Australia, restricted there seemingly to a solitary locality."

"Strange, however, is the almost total absence of ferns, only *Acrostichum aureum* representing that otherwise large and lovely order among about 400 species of plants now gradually accumulated in collections from the district."

The arrangement of orders is most bewildering to the American botanist, doing violence to all his ideas of system. Apetalous, monopetalous and polypetalous orders are to be found mixed in every way. It also looks queer to see the genus *Andropogon* among the *Amarantaceæ*, as well as among Grasses. The country is a great one, though, and many a rich harvest of plants is waiting to be reaped.

HERBARIUM,
NEW YORK.

Botanical Gazette.

Vol. VI. OCTOBER, 1881. No. 10.

Editorial.—The Monthly Index, published at 10 Spruce St., New York, is an exceedingly convenient publication. In it we have each month a complete classified list of the periodical literature of every department of thought, except fiction. Looking under the appropriate heading a botanist can find all that has been published the previous month relating to his own science, and can thus procure whatever is of special interest.

Sir John Lubbock, in his inaugural address as presiding officer of the recent meeting of the British Association, made the following remarks in illustration of the progress of the Science of Botany in the last half century: "Some of the most fascinating branches of botany—morphology, histology, and physiology—scarcely existed before 1830. In the two former branches the discoveries of von Mohl are pre-eminent. He first observed cell-division in 1835, and detected the presence of starch in chlorophyll-corpuscles in 1837, while he first described protoplasm, now so familiar to us, at least by name, in 1846. In the same year Amici discovered the existence of the embryonic vesicle in the embryo-sac. The existence of sexual reproduction in the lower plants was doubtful, or at least doubted by some eminent authorities, as recently as 1853, when the actual process of fertilization in the common bladderwrack of our shores was observed by Thuret, while the reproduction of the larger fungi was first worked out by de Bary in 1863. As regards lichens, Schwendener proposed, in 1869, the startling theory, now however accepted by some of the highest authorities, that lichens are not autonomous organisms, but commensal associations of a fungus parasitic on an alga. With reference to the higher Cryptogams it is hardly too much to say that the whole of our exact knowledge of their life history has been obtained during the last half century. Thus in the case of the ferns the male organs, or antheridia, were first discovered by Nageli in 1844, and the archegonia, or female organs, by Suminski, in 1848. The early stages in the development of the mosses were worked out by Valentine in 1833. Lastly, the principle of alternations of generations in plants was discovered by Hofmeister. This eminent naturalist also, in 1851–4, pointed out the homologies of the reproductive processes in mosses, vascular cryptogams, gymnosperms and angiosperms.

Baron Ferd. von Mueller has sent to Kew Gardens a living specimen of his recently described Australian Cycad, *Macrozamia Moorei*. The stem sent is four feet high, five and a half feet in circumference, and weighs six hundred pounds. Specimens have been seen twenty feet high and six feet four inches in circumference, with

cones two to three feet long, and leaves seven feet long. For a Cycad this is most remarkable.

M. PLANCHON reports a new species of *Cissus* from the interior of Sierra Leone, capable of bearing the winter of Marseilles. Its endurance is a matter of temperament, and a proof of the extent of the scale of resistance to cold and heat which some plants possess, and which often upsets all prevision.

THE JOURNAL OF BOTANY for September gives quite a full account of the life and character of the late Mr. H. C. Watson, the eminent English botanical geographer, who died the 27th of July. The article is accompanied by an excellent portrait.

MR. G. S. JENMAN has described a new tree fern from Jamaica, which he calls *Cyathea monstrabilia*. Its trunk is four or more feet high and three inches in diameter, while the fronds are three or four feet long and 15–20 inches wide.

MR. HENRY M. DOUGLASS, of Richland, N. Y., is publishing a translation of the *Botanische Zeitung* which he calls the *Botanical News*. The subscription price is fixed at $2.50 per year.

MR. L. F. HENNEGUY confirms the observations of Brant that an aqueous solution of aniline brown, known in commerce as Bismarck brown, will give an intense brownish-yellow color to the protoplasm of the infusoria without in any way interfering with their enjoyment of life. The coloration first appears in the vacuoles of the protoplasm, then this latter is itself stained, the nucleus being most generally not at first colored, and so being made more conspicuous. Experiments made on vegetable protoplasm seemed to exhibit the same result.

PROF. E. S. BASTIN, of Chicago, has found near Lake Michigan a most curious form of *Cypripedium spectabile*. A single stem bears two flowers, one normal and the other almost regular. This "monster" had three distinct and equal sepals; three nearly equal petals, shaped like the sepals, but narrower, and with no trace of a "slipper;" ovary not at all twisted; three distinct anthers instead of two; three-lobed stigma. Instead of the triangular fleshy body, heretofore supposed to represent the third stamen, there were two of these bodies alternating with the petals, and if representing stamens at all, they must be an outer whorl. Of course two whorls of stamens are just what we want, for they are more typical than one. This *Cypripedium* seemed to have taken a long stride backwards towards some of its ancestral forms that were regular.

THE SUMMER SCHOOL OF BOTANY in the University of Minnesota, seems to have been a success, about forty teachers having enrolled themselves. Prof. Bessey gives the outline of his laboratory course as follows: I. *General Histology of Plants.*—Protoplasm in hairs and tissues, cells, cell walls and their markings, chlorophyll, starch, plant crystals, parenchyma, collenchyma, sclerenchyma, fibrous tissue, laticiferous tissue, sieve tissue, tracheary tissue, epidermis, stomata, hairs, fibro-vascular bundles. II. *The Structure and Physiology of Cryptogmas.*—(1) The Sexless Plants (Protophyta), Protococcus, Nostoc, Oscillatoria, Rivularia, yeast plant, Bacteria; (2) The Unisexual Plants (Zygosporeæ), Hydrodictyon, Conferva, Desmids, Diatoms, Spirogy-

ra, Mucor; (3) The Egg-spore Plants (Oosporeæ), Œdogonium, Vaucheria, Peronospora, Cystopus, Fucus; (4) The Red Seaweeds and their allies (Carposporeæ), Podosphæra, Eurotium, Parmelia, Puccinia, Agaricus; (5) The Mosses and their allies (Bryophyta), Marchantia, Mnium; (6) The Ferns and their allies (Pteridophyta), fern prothallia and fruiting, Pteris, Polypodium, Selaginella. III. *The Structure and Physiology of Phanerogams.*—The structure of Gymnosperms; the sexual reproduction of Monocotyledons; the sexual reproduction of Dicotyledons.

Notes.—Those who have had the pleasure of seeing that lovely tree, the *Magnolia grandiflora*, in bloom in its native haunts, and who live north of Maryland, must have ceaseless regret that it is not generally hardy in their district. A few trees live and bloom in sheltered situations above the state mentioned. A single specimen in this city (Wilmington, Delaware) blooms freely nearly every year. Through the kindness of the owner, J. H. Jackson, Esq., I am enabled to give the following record of the period of its flowering for the years mentioned. The dates given are of the first and last flowers and show the *period* of flowering to be much longer than might be supposed; of course much the greater number of flowers appear during the first four weeks.

1873, from June 20 to _____.
1874, " June 22 to August 19.
1875, " June 21 to August 5.
1876, " June 11 to August 10.
1877, " June 11 to August 1.
1878, " May 30 to August 22.
1879, " June 9 to August 17.
1880, " May 28 to _____.

1881, tree survived the excessive cold of last winter and bloomed, but less freely than usual. No record has been kept since the last date mentioned.

THE PENINSULA between Delaware and Chesapeake bays has generally a light, rather thin sandy soil, which does not differ materially from that mostly prevalent in the Atlantic coast region from Long Island southward. Yet it produces some noble forests of both evergreen and deciduous trees. Some of your readers may remember the splendid specimens of black walnut and tulip trees, shown at the Centennial Exhibition by the Delaware State Commission. These were respectively 7 and 9 feet through and were perfectly sound and solid. While in Southern Delaware, some months since, I measured a Cypress (*Taxodium*) stump, 9 feet across. A Post Oak (*Quercus stellata*) measured 16 feet in circumference at 3 feet from the ground. *Pinus Tæda* and *Pinus mitis* attain a height of 100 feet and a girth of 10 to 14 feet. Even *Pinus inops* which is usually considered a low and straggling tree, was seen at least 60 feet in height. Some specimens of *Alnus maritima* (a species perhaps exclusively found in this district) may well rank as trees. Here are measurements of three individuals.

No. 1, 25 feet high, 13 inches in circumference near base.
No. 2, 32 feet 8 inches high, 13 inches " "
No. 3, 31 " 1 inch " 16 " " "

THE MISTLETOE is frequent in this region and always, so far as I have observed, found on *Nyssa multiflora* or *Acer rubrum*. In last September it was seen in fine fruit and also in full flower. The books which I can consult, give the flowering period as April or May. This, I believe, is correct in the far south. Can it be, that in more northern localities it flowers in the fall and perfects its fruit the next year, as is the case with *Hamamelis* and *Alnus maritima?* I should be glad to have information upon this point.—WM. M. CANBY.

Calamagrostis Howellii, n. sp.—Culms densely tufted, 10-20 inches high, erect, or somewhat geniculate below, smooth; radical leaves loosely setaceous involute, firm but not rigid, in length nearly equalling or even exceeding the culm, ligule conspicuous, about 1½ lines long, scarious, culm leaves about 3, narrow or filiform, 4 to 8 inches long, the upper one equalling the culm; panicle pyramidal, 2 to 4 inches long, loose and spreading, rays mostly in fives, lower ones 1 to 1½ inches long, numerously flowered above the middle; spikelets pale green or purple tinged, outer glumes lanceolate, acute, 2½ to 3 lines long, nearly equal, membranaceous, 1-nerved or the upper indistinctly 3-nerved, flowering glume slightly shorter than the outer ones, ovate-lanceolate, acute, 4-nerved above, the apex with 2 mucronate pointed teeth, the conspicuous strong awn inserted about the lower third, half an inch long, palet rather shorter than its glume, bidentate at the apex, basal hairs about half as long as the flower, those of the rudiment rather longer.

A well marked and handsome species, remarkable for the long setaceous leaves, both radical and cauline, and for the open panicle and conspicuous awns. It is named for the discoverer, *T. J. Howell*, Oregon.—GEO. VASEY.

Blight.—Editors BOTANICAL GAZETTE:—Please permit me to call the attention of your readers who are adepts in the use of the compound microscope, to the subject of disease in plants by *bacteria*. Last year accounts of my own investigations were published in the transactions of the American Association for the Advancement of Science, Scientific American, American Naturalist, and elsewhere. These had special reference to the so called "fire blight" of the pear and "twig-blight" of the apple tree. Some much more limited studies upon the "yellows" of the peach were also published in "Science." The proofs offered in these accounts were such as:—

1. The uniform presence of a certain species of *Bacterium* in the dying tissues.

2. The appearance of the disease upon inoculating healthy limbs with this *Bacterium*.

3. The observed multiplication of the organism and the gradual spread of the disease from the point of inoculation.

The results fully convinced me that these diseases of our orchard trees are directly due to the operations of this minute cryptogamic

plant, whatever may be the indirect surroundings and conditions rendering such operations possible. The experiments of last year have been repeated and verified during the present season (1881), and further research has shown that fruit trees are in no wise peculiar in this respect. Many other plants suffer in a similar manner from the same cause. Among trees, none are more certainly and surely destroyed in this way than the Lombardy poplar, whose dead or dying spires so commonly attract the attention of the most casual observers throughout our land. *Populus tremuloides* dies still more apparently like the pear tree. The butternut and the linden succumb to the same destroyer. Ash and elm trees do not fully escape; the maples, especially the "sugar tree," often similarly suffer. Shrubs and herbaceous plants are also injured or killed outright by the avaricious, omnivorous little creatures. The leaves of the white flowered lilac wither upon their stems before they have half filled their proper duties, and those of the common pæony die while the summer's sun invites them to fuller development and activity.

In these and many other instances, the destroying agent is almost surely one and the same, though the appearance and even characteristics differ very much in the resulting effects upon different subjects. The pear tree more commonly becomes diseased throughout the entire stem and its appendages, while the young twigs of the apple tree often alone perish or a limited area of the bark upon the trunk dies. In the lilac it is the leaves which suffer, the branchlets bearing them continuing in perfect health. In the case of the Lombardy poplar the small limbs perish only because the larger parts are destroyed. So far as I have observed, the leaves are not at all infected. If the yellows of the peach is really due to the same specific *Bacterium*, a still further difference is shown, for this tree does not die by inches, the disease beginning in some well-defined place, and gradually spreading, as in the other cases. The whole top languishes, and it has been supposed that the roots were also involved. My studies upon this disease have been confined to severed specimens sent to me through the mail, but in no instance have I found the pieces of roots taken from diseased trees infected with bacteria; the diseased limbs always are. In the pear, apple, poplar, etc., the roots are *never* the seat of the disease, and become infected, if at all, only through the contagion from the trunk.

Inoculations with fresh material (bacteria) are as certain to communicate the disease as are similar operations upon animals. Vaccination as practiced against small-pox is not successful in a greater number of instances than is this method of producing blight. In last year's experiments sixty three per cent. of the total number of inoculations in pear and apple unmistakably communicated the disease. By operating on what became known as the most susceptible parts and kinds, a much greater per cent. succeeded, approaching near to one hundred. Similar punctures with a clean needle had no effect whatever. Application to the outside of the unbroken epidermis was ineffectual. These results are corroborated by similar experiments this year, not however prosecuted to the same extent.

There are to my mind many interesting questions left unsolved,

but the main proposition is, it seems to me, as thoroughly demonstrated as any physiological or pathological matter can be. There are no speculations or unfounded theories admitted; experiments, observations and results. I should be pleased to know if others have tried such experiments.—T. J. BURRILL.

Forest Notes.—While on a recent trip in the Boston Mountains, I found *Acer rubrum* growing several hundred feet above the drainage of the surrounding country on sandy, dry ridges. It surprised me because I had never found this species growing in the river bottoms of this region where *Acer dasycarpum* is quite common.

I had always thought that *Acer rubrum* was confined to the low country. I found *A. saccharinum* growing in the same situations.

Carya myristicæformis was found, for the first time in this State, last summer, in the Red River bottom above Fulton, and this summer, it was observed in great abundance in South-Eastern Arkansas, from about Pine Bluff almost to the south boundary, growing with *Carya aquatica* in low situations. The nut of this species is about the size of a pecan, and is edible. It is called swamp hickory by the natives, and in some localities "conscript hickory-nut," by the darkies.

Planera aquatica is distributed throughout Eastern and Southern Arkansas.

Quercus Michauxii is the principal species of the white oaks found in South-Eastern Arkansas. It assumes majestic proportions, some specimens having a diameter of 19 feet.

A specimen of *Euonymus atropurpureus*, 7 inches in diameter, and 30 feet high, was observed in the vicinity of Little Rock. The tree was full of fruit, and the identification thus made easy and certain.

We were surprised by not seeing any of the *Magnolias* in South-Eastern Arkansas, as we had expected to find several species.

Pinus Tæda grows in Arkansas as far north as Little Rock. This species and *P. mitis* are the members of this genus we have found in the State.—F. L. HARVEY, *Fayetteville, Ark.*

Hieracium aurantiacum.—Mr. Meehan on page 265 of the current number of the Gazette, in speaking of *Hieracium aurantiacum L.* (*Crepis*), desires that stations may be recorded. In volume V. of the Bulletin of the Torrey Botanical Club, page 32, I recorded its first appearance in this State. This was in 1874. Since then I have observed it every year, but have not seen in it any decided tendency to increase. As it is proliferous at the base, it would seem well calculated to spread. It has been found by Mr. Arnold Green, Mr. Thomas Battey and myself at various points in this State. I have a location for it here in the city of Providence, in one corner only of a hayfield, from which it has extended into the street. The lot, although nominally in the city, is in effect far removed from the town proper. It is always possible to collect here a number of plants, and I usually keep a stock for distribution.—W. WHITMAN BAILEY.

Andropogon and Amarantaceæ.—As you correctly remark, it looks queer to see the genus *Andropogon* among the *Amarantaceæ*, as

well as among the grasses (see page 267). It may save some misapprehension of Dr. Mueller's own work to add that this is evidently one of those sins not unusually committed by printers in the make up of pages, and which so often leads authors to pray heartily that the printer may be forgiven. This is apparent from other errors on the same page, *Andropogon* being wedged in between different species of *Ptilotus*, and some species of *Gomphrena* being placed both above and below *Ptilotus*, instead of all in one sequence as they should be.—THOS. MEEHAN.

Notes from Dayton.—CONOBEA MULTIFIDA.—In your catalogue of Indiana plants, I notice the remark, "leaves in threes." I have collected this plant in Ohio, Indiana and Illinois, and have generally found the leaves arranged ternately, although occasionally the binate type was also found.

NESÆA VERTICILLATA.—Besides finding the leaves opposite and whorled, I have also seen them arranged alternately. The quarnate arrangement of leaves is frequently seen in whorls close to the ground. The ternate, in whorls subtending the flower clusters; the binate, on non-flowering branches; and the alternate, in the last shoots of the season.—AUGUST F. FOERSTE.

New Species of Fungi, by Charles H. Peck.—POLYPORUS ABORTIVUS.—Pileus small, plane or centrally depressed, often deformed or wanting, whitish or alutaceous, the superior stratum soft and spongy, composed of a compact tomentum, the inferior firm, subcorky, continuous with the central substance of the stem; pores small, unequal, decurrent, whitish, with thin dentate or lacerated dissepiments; stems central, irregular, sometimes short or obsolete, centrally firm, externally soft, spongy-tomentose; spores globose or broadly obovate, .0002—.0003 of an inch long, generally containing a single large nucleus.

"Ground under an elm tree." Illinois. *J. Wolf.* Communicated by *Prof. S. A. Forbes.*

Var. *subglobosus.* Plant consisting of a depressed or subglobose mass, having the stem very short or obsolete, the central substance marked by concentric zones and the surface everywhere porous.

"Bark of an old hickory log." Mt. Carmel, Illinois. *J. Schneck, M. D.*

This curious Polyporus appears to belong to the section MESOPUS, Division Spongiosa, and to be related to *P. biennis.* The specimens sent me are scarcely more than an inch or an inch and a half in diameter, and none of them seem to be well developed, although affording spores in great abundance. More specimens are desirable.

TRAMETES PECKII *Kalchbrenner in litt.*—"Pileo suberoso, dimidiato, sessili, subdecurrente, hirsuto. azono, ferrugineo-fusco, demum expallente, margine acuto; poris majusculis, rotundato angulatis, pileo subconcoloribus vel senio fuscescentibus; substantia lignei coloris.

A priore (An American form of *Trametes Trogii* B.) abunde differt hirsutie longiore, minus scabra, poris multo majoribus, obscurioribus, etc."

Pileus corky, dimidiate, sessile, subdecurrent, hairy, zoneless, brownish-ferruginous, becoming pale, the margin acute; pores rather large, varying from rotund to angular, colored nearly like the pileus or when old becoming brown; substance wood-color.

Dead trunks of cottonwood trees, *Populus monilifera*, *P. angulata*, etc., Dakota. *C. W. Irish.*

PHYLLOSTICTA ASTRAGALI.—Spots none or indefinite; perithecia numerous, often occupying both surfaces of the leaf, .007–.011 of an inch in diameter, rupturing the epidermis and partly covered by it, black, opening by a minute circular aperture; spores oblong or oblong-fusiform, colorless, .0005—.00065 of an inch long, .00012 broad.

Living, languishing or dead leaves of species of Astragalus. Canada. *Prof. J. Macoun.*

The fungus appears to kill the leaves. The spores sometimes have a faint semblance of a central transverse septum, which is apparently produced by the retraction of the endochrome toward each end.

MELANCONIUM TYPHÆ.—Nucleus very minute, dot like or narrowly elliptical, at first covered by the epidermis which at length ruptures either irregularly or longitudinally; spores oblong-fusiform, black, .0004—.0005 of an inch long, .00016 broad, somewhat persistently attached to their sporophores.

Dead leaves of *Typha angustifolia*. Charlotte, Vermont. June. *C. G. Pringle.*

This fungus is somewhat anomalous both in its minute size and in the persistent attachment of the spores to their sporophores, yet it appears to belong to the genus to which it is here referred.

ÆCIDIUM POLYGALINUM.—Spots yellowish, indefinite, sometimes occupying the whole leaf; peridia hypophyllous, crowded or scattered, short, the margin crenulate-lacerate; spores subglobose, .0008—.0011 of an inch long.

Living or languishing leaves of *Polygala Senega*. Ann Arbor, Michigan. *Prof. V. N. Spaulding.*

The Æcidium in our specimens is associated with *Septoria consocia*. The spores are whitish, but probably in the fresh specimens they are yellow or orange.

ÆCIDIUM XANTHOXYLI.—Spots suborbicular, greenish-yellow; peridia short, hypophyllous, crowded; spores subglobose, .0009—.001 of an inch in diameter.

Living leaves and petioles of prickly ash, *Xanthoxylum Americanum*. Iowa. *E. W. Holway.*

The spores in the dried specimens are whitish, but they are probably yellow or orange in the fresh state.

PUCCINIA PRINGLEI.—Spots small, numerous, suborbicular, purplish on the lower surface of the leaf, concealed by the sori on the upper surface; sori epiphyllous, rarely hypophyllous, large, rather compact, occupying the whole spot, blackish-brown; spores oblong or subelliptical, slightly constricted at the septum, obtuse or subacute,

usually pale at the apex, verruculose, .0016–.002 of an inch long .0008–.0009 broad; pedicel colorless, generally about half as long as the spore.

Living leaves of *Viburnum pacuiflorum*. Canada. Aug. *C. G. Pringle.*

The spots are from one-half to one line broad. Each spot is generally occupied by a single sorus. Rarely a few sori appear along the principal veins on the lower surface of the leaf. The verrucæ or warts are irregularly scattered, but sometimes they manifest a tendency to a linear or longitudinal arrangement, and they are generally more numerous toward the apex of the spore. This is an interesting addition to the few species of Puccinia that inhabit the leaves of trees or shrubs. It is respectfully dedicated to its discoverer.

PUCCINIA HYSTERIIFORMIS.—Spots obsolete; sori scattered, rather large, oblong, at first covered by the epidermis which is at length ruptured longitudinally, black; spores oblong or oblong-clavate, blunt or pointed, strongly constricted at the septum, .0016—.0019 of an inch long, about .0008 broad; pedicel generally longer than the spore.

Living leaves of *Arenaria verna*. Utah. May. *Prof. M. E. Jones.*

The oblong sori and longitudinally ruptured epidermis present an appearance not unlike that of some species of Hysterium and suggest the specific name.

TRICHOBASIS BALSAMORHIZÆ.—Spots indefinite, brownish; sori scattered, sometimes confluent, amphigenous, reddish-brown; spores globose or subglobose, minutely rough; .0011–.0012 of an inch long, often containing one to three nuclei; pedicel nearly equal to the spore in length, soon deciduous.

Living leaves of *Balsamorhiza macrophylla*. Utah. May. *M. E. Jones.*

This will probably prove to be the stylosporiferous condition of some Puccinia or Uromyces. The large patches formed by the confluence of the sori occur mainly on or along the principal veins or midrib.

UROMYCES BOREALIS.—*Hymeniferous state.*—Spots none; peridia mostly epiphyllous, scattered or rarely collected in small clusters, short, white; spores subglobose, .00065–.0008 of an inch long.

Teleutosporiferous state.—Sori mostly epiphyllous, scattered, small, black or blackish-brown; spores obovate or subelliptical, smooth, .001–.0012 of an inch long, .0005–.00065 broad, with a prominent pale umbo at the apex; pedicel very short.

Living or languishing leaves of *Hedysarum boreale*. Canda. *C. G. Pringle.* Also on *Hedysarum Mackenzii*. *J. Macoun.*

In the dried specimens the Æcidium spores are whitish, but probably they are yellow in the fresh state. Sometimes a sorus surrounds a peridium of the Æcidium, in which case the appearance is that of a black dot with a white center.

USTILAGO OSMUNDÆ.—Spores produced in the pinnules of the fern, globose, brown, rough or verruculose, .0005–.0006 of an inch in diameter; the affected pinnules deformed, discolored, roughened and contracted into tufts.

Fronds of *Osmunda regalis*. Vermont. Aug. *C. G. Pringle.*

The loose, irregular and discolored tufts of pinnules at first sight are suggestive of the work of insects. The fungus in some instances breaks forth along the midvein of the pinnule, but generally the whole surface is roughened and defiled by it. The color of the affected pinnules varies from rusty or cinnamon brown to blackish-brown The fungus is a singular one, and but a single specimen was communicated to me. Further investigation of it is desirable.

CERCOSPORA TILIÆ.—Spots small, numerous, suborbicular, brown with a paler center; flocci tufted, hypophyllous, minute; spores bacillary, brownish or cinereous, three to five-septate, .001–.0016 of an inch long, .00015–.00016 broad.

Living leaves of *Tilia Americana*. Charlotte, Vermont. June. *C. G. Pringle.*

The center of the spots on the upper surface is sometimes tinged with reddish-brown, on the lower surface, with cinereous.

ZYGODESMUS ATRORUBER.—Flocci creeping, intricate, branched, more or less rough or granular, forming a thin effused, dark-red, tomentose stratum, spores subglobose, echinulate, .00025–.0003 of an inch long.

Decaying poplar wood. Mt. Tom, Massachusetts. November. *H. W. Harkness, M. D.*

This species is readily known by its dark vinous-red color. It is apparently allied to *Z. effusus*, a species said to be alutaceous in color.

ZYGODESMUS GRANULOSUS. — Flocci slender, smooth, much branched, forming an effused ochraceous-brown stratum, the surface of which is covered with granules; spores subglobose, echinulate, about .0003 of an inch long.

Decaying birch wood. Mt. Tom, Massachusetts. November. *H. W. Harkness.*

This is related by its granulose surface to *Z. hydnoides*, but that species is described as rubiginous or rust colored, and its spores are said to be .0006 of an inch in diameter.

Caruel's New System of Plants.—We were so interested in looking over Prof Bessey's notice under the above caption in the last *American Naturalist*, that we take the liberty of copying it: In the last number of his *Giornale Botanico Italiano*, Caruel proposes a system of plants which contains so many interesting points that it will be profitable to reproduce it here in a condensed form. He recognizes five grand divisions, viz: Gymnogamæ, Bryogamæ, Schistogamæ, Prothallogamæ and Phanerogamæ. The first is equivalant to the Thallophyta of many German botanists, but is treated very differently by the author. The Myxomycetes are very properly placed at the lower end of the division, in a separate class, the Plasmodieæ. In accordance with the rapidly growing idea first brought out by Cohn, the chlorophyll-bearing and chlorophyll-free plants are not separated as Algæ and Fungi; and the lichens are considered an order constituting with the Sphærideæ and Gymnoascideæ the cohort Angiosporatæ, the latter very nearly equivalent to the Ascomycetes of botanists. The

radical error, as it appears to us, in Caruel's disposition of the plants of the class Thallodeæ consists in making use of the asexual reproductive bodies in characterizing the sub-classes. Conidia and zoospores at least, and almost certainly the tretraspores also (chains of four conidia?), are homologues, whose differences are related to differences in the habitat of the plants producing them. Conidia (if we except tetraspores) are aerial, while proper zoospores are aquatic.

The position assigned to the Characeæ is scarcely a tenable one. They are too nearly related to the Floridiæ, and too distantly to the ferns to warrant placing them between the Bryogamæ and Prothallogamæ.

The separation of the Phanerogamæ into three classes will strike every one as an innovation of doubtful value. Why the orthography of Gymnospermæ should be changed to Gynospermæ, is also to be questioned. It will be observed that the cohorts and orders of the Angiospermæ rank higher respectively than do the groups bearing these names in the system most in vogue in this country: the families (omitted for want of space) in Caruel's system, are almost the equivalents of the orders of Bentham and Hooker, while Caruel's orders are nearly equivalent to Bentham and Hooker's cohorts.

Division GYMNOGAMÆ.

Class PLASMOIDEÆ.

Cohort *Plasmodiatæ*.

Order Myxomycetes; Fam. Ceratiaceæ, Trichiaceæ.

Class THALLODEÆ.

Sub-class SCHIZOSPOROPHORÆ.

Cohort *Schizosporatæ*.

Order Nostochideæ; Fam. Chroococcaceæ, Oscillariaceæ, Nostocaceæ, Rivulariaceæ, Scytonemaceæ.

Sub-class CONIDIOPHORÆ.

Cohort *Gymnosporatæ*.

Order Pucciniideæ; Fam. Sporotrichaceæ, Fusariaceæ, Stilbaceæ, Trichodermaceæ Ustilaginaceæ, Pucciniaceæ.

Order Agaricideæ; Fam. Exobasidiaceæ, Tremellaceæ, Agaricaceæ, Lycoperdonaceæ.

Cohort *Angiosporatæ*.

Order Gymnoascideæ; Fam. Gymnoascaceæ.

Order Sphærideæ; Fam. Helvellaceæ, Sphæriaceæ, Erysiphaceæ, Tuberaceæ.

Order Lichenideæ; Fam. Myriangiaceæ, Verrucariaceæ, Parmeliaceæ.

Sub-class ZOOSPOROPHORÆ.

Cohort *Euzoosporatæ*.

Order Ulvideæ; Fam. Cladophoraceæ, Ulvaceæ, Sphacelariaceæ, Sporochnaceæ.

Cohort *Zygosporatæ*.

Order Pandorinideæ; Fam. Botrydiaceæ, Pandorinaceæ, Ulotrichaceæ.

Order Zygnemideæ; Fam. Diatomaceæ, Desmidiaceæ, Zygnemaceæ.

Order Peronosporideæ; Fam. Mucoraceæ, Chytridiaceæ, Peronosporaceæ, Saprolegniaceæ.

Cohort *Oosporatæ*.

Order Vaucherideæ; Fam. Monoblepharidaceæ, Volvocaceæ, Vaucheriaceæ, Sphæroplaceæ, Œdogoniaceæ. Coleochætaceæ.

Order Fucideæ; Fam. Ectocarpaceæ, Fucaceæ.

Sub-class TETRASPOROPHORÆ.

Cohort *Tetrasporatæ*.

Order Pseudoflorideæ; Fam. Porphyraceæ, Dictyotaceæ.
Order Florideæ; Fam. Ceramiaceæ, Nemaliaceæ, Lemaneaceæ, Sphærococcaceæ, Melobesiaceæ, Rhodomelaceæ.

Division BRYOGAMÆ.

Class MUSCINEÆ.

Cohort *Muscineæ*.

Order Hepaticæ; Fam. Anthocerotaceæ, Ricciaceæ, Targioniaceæ, Monocleaceæ, Marchantiaceæ, Jungermanniaceæ.
Order Musci; Fam. Andreæaceæ, Phascaceæ, Sphagnaceæ, Bryaceæ.

Division SCHISTOGAMÆ.

Class PUTERÆ.

Cohort *Puteræ*.

Order Puteræ; Fam. Characeæ.

Division PROTHALLOGAMÆ.

Class ISOSPOREÆ.

Cohort *Isosporeæ*.

Order Filicariæ; (1) Sub-order Trichosporangiæ; Fam. Hymenophyllaceæ, Polypodiaceæ, Gleicheniaceæ, Osmundaceæ.
(2) Sub-order Phyllosporangiæ; Fam. Marattiaceæ.
(3) Sub-order Ophiosporangiæ; Fam. Ophioglossaceæ.
Order Calamariæ; Fam. Equisetaceæ.
Order Conariæ; Fam. Lycopodiaceæ.

Class HETEROSPOREÆ.

Cohort *Heterosporeæ*.

Order Phyllocarpariæ; Fam. Selaginaceæ, Isoetaceæ.
Order Rhizocarpariæ; Fam. Salviniaceæ, Marsiliaceæ.

Division PHANEROGAMÆ.

Class GYNOSPERMÆ.

Cohort *Coniferæ*.

Order Strobiliifloræ; Fam. Cycadaceæ, Pinaceæ, Taxaceæ, Gnetaceæ.
Order Conifloræ; Fam. Welwitschiaceæ.

Class ANTHOSPERMÆ.

Cohort *Dendroïcæ*.

Order Spermifloræ; Fam. Viscaceæ, Loranthaceæ.

Class ANGIOSPERMÆ.

Sub-class DICOTYLEDONES.

Cohort *Dimorphanthæ*.

Orders Julifloræ, Globifloræ, Calicifloræ, Urticifloræ, Euphorbifloræ, Begonifloræ.

Cohort *Monochlamydanthæ*.

Orders Nudifloræ, Involucrifloræ, Ranifloræ, Cactifloræ, Cytinifloræ, Daphnifloræ.

Cohort *Dichlamydanthæ*.

Orders Cirrifloræ, Myrtifloræ, Lythrifloræ, Rosifloræ, Tiliifloræ, Crucifloræ, Rutifloræ, Ericifloræ, Primulifloræ, Celastrifloræ, Umbellifloræ, Oleifloræ, Campanifloræ, Asterifloræ, Corollifloræ.

Sub-class MONOCOTYLEDONES.

Cohort *Centranthæ*.

Order Centrifloræ.

Cohort *Hydranthæ*.

Orders Fluviifloræ, Alismifloræ.

Cohort *Liriantha*.

Orders Glumifloræ, Spadicifloræ, Liliifloræ, Labellifloræ.

COLUMBIA COL.
HERBARIUM,
NEW YORK.

Botanical Gazette.

Vol. VI. NOVEMBER, 1881. No. 11.

Editorial.—M. D'ARBAUMONT has begun the publication of an elaborate paper on the anatomy of "The Stem of the Ampelidæ."

TRIMEN'S JOURNAL for October records the death of Frederick Currey, for 20 years secretary of the Linnean Society.

WE BROUGHT Dr. Gray home sooner than he intended. He sails from England on October 26, arriving here probably about the 4th or 5th of November.

DR. J. SCHNECK has found *Artemisia annua* growing plentifully in Daviess county, Ind., and says that it was the greenest weed to be seen at the end of the nine weeks drought.

MR. C. G. PRINGLE has spent the past summer in the west. He has collected many good things in Arizona, near Tucson, and is now in Oregon. Such a collector will bring in much new material.

MR. J. A. SANFORD, of Toledo, Ohio, is preparing a catalogue of Lucas County plants. Such a county should yield richly, as it lies along the lake and contains the swampy mouth of the Maumee River.

MR. THOS. MEEHAN has been observing *Talinum teretifolium* and finds that its flowers always open regularly at 1 p. m.; though for one season they closed promptly at two and the next at any time between two and five.

THE YORKSHIRE NATURALISTS' UNION has what are called "Fungus Forays," to which all mycologists are cordially invited. Why not have "Lichen Liftings," "Moss Meanderings," "Fern Frolics," and "Exogenous Excursions?"

PROF. W. J. BEAL has 200 different grasses and clovers growing, each in a separate bed, in the garden attached to the Michigan Agricultural College. It has taken several years to make the collection, which is being added to yearly.

SIR JOHN LUBBOCK in observing the seeds of *Stipa pennata* has discovered that they take advantage of the action of the wind, and are thus buried by the corkscrew-like movement of the twisted awn. In his observations apparently the question of hydroscopic action was eliminated.

PROF. F. L. HARVEY, in the last GAZETTE, p. 273, was made to say that *Quercus Michauxii* in Arkansas attained the prodigious size of 19 feet in diameter. He asks us to change the word "diameter" to "circumference," so that the statement may sound more within the bounds of reason.

Dr. H. F. Hance, in the October number of Trimen's Journal, describes a new genus of *Taccaceæ*, which he calls *Schizocapsa*. The only other genera of the order are *Tacca* and *Ataccia* which the author is inclined to retain as entitled to rank as separate genera. The new genus comes from China.

As we go to press we learn with great regret of the death of Dr. A. P. Garber, whose name is so familiar in connection with the plants of Florida. In the next Gazette may be expected a short memoir written by Prof. T. C. Porter, who probably knew him better than any other of his associates.

According to Dr. Farlow, DeBary is not willing to go as far as Sachs in giving up the general distinction of algæ and fungi, although recognizing their close relationship. This whole thing of the classification of Cryptogams is enveloped in a blinding mist, and no man knows when it will clear away.

M. J. Vesque, in the current number of Ann. Sci. Nat., describes and figures some "New Elements in the Liber of Acanthaceæ." They are needle-shaped bodies, occurring in great numbers in certain cells of the liber, and at first glance would be called raphides; but the proper reagents show them to consist of cellulose incompletely lignified. As many as a score of these cellulose needles are contained in large cells which are ordinarily pointed at both ends.

Sir Joseph Hooker, in his recent address before the Geographical section of the British Association, said that Humboldt was the founder of the science of geographical distribution, Forbes its reformer, and Darwin its latest and greatest law-giver. The first naturalist to investigate as a botanist the laws of distribution from a paleontological standpoint was Dr. Asa Gray and the brilliant results are well known to us in that wonderful chapter upon the relation of our own flora to fossils found in Arctic regions.

Mr. Thiselton Dyer has propounded the latest theoretical application of the laws of geographical distribution, which Sir Joseph Hooker states as follows: The floras of all the countries of the globe may be traced back at some time of their history to the northern hemisphere, and they may be regarded in point of affinity and specialization as the natural results of the conditions to which they must have been subjected during recent geological times, on continents and islands with the configuration of those of our globe.

M. P. Sagot, in the last number of Annales des Sciences Naturelles, begins a catalogue of the phænogomous and vascular cryptogamous plants of French Guyana, the country with the peppery capital. Of course the names are for the most part unfamiliar, and families of no importance with us make grand displays in this tropical colony. For instance, the very first family mentioned is the *Anonaceæ*. The six species belonging to the whole of North America are replaced by 33 species in this little patch of South America, containing but 25,000 square miles.

Prof. W. J. Beal has been writing about "Indian Corn." His

paper is of interest to every one and shows with what care the author works in the collection of facts, not only from others, but from his own experiments. He says that corn is a variable and plastic plant and exceedingly sensitive to good or bad treatment, and hence much can yet be done to improve it Among many other interesting statistics we note some relating to the size of corn stalks. The tallest the author had seen was 14½ feet high, being raised in Michigan from Missouri seed. The largest on record was raised in Eastern Tennessee and measured 22¼ feet. A field of such corn would look like a cane brake.

Mr. A. W. Bennett has been observing the constancy of insects in visiting flowers, which becomes an important question in the matter of cross-fertilization. His results show a constancy that was hoped for, and bees and butterflies are quite constant enough in their attentions to single species to secure all that is claimed in cross-fertilization. It seems that insects are not entirely guided by color in their discrimination of species, for in patches of white and purple foxgloves the bumblebees would enter the flowers regardless of color, though to find a succession of foxgloves they had to fly considerable distances over other flowers. The hive bee proved to be the most constant visitor, and probably the most efficient agent of cross-fertilization.

Fritz Mueller, in a recent letter to Mr Chas. Darwin, written from Sta. Catharina in Brazil, says: "We have had last week some rather cold nights (2° to 3° C. at sunrise), and these have given me a new confirmation of your view on the meaning of the nyctitropic movements of plants. Near my house there are some Pandanus trees, about a dozen years old; the youngest terminal leaves stand upright, whereas the older ones are bent down so as to expose their upper surfaces to the sky. These young leaves, though of course the most tender, are still as fresh and green as before; on the contrary, the older ones have suffered from the cold, and have become quite yellowish. Again, the leaves of *Oxalis sepium* were observed by me to sleep in a very imperfect manner during the summer, even after the most sunny days; but now, in winter, every leaflet hangs down in a perpendicular position during the whole night." Whereupon Mr. Darwin remarks that it is a new fact to him that leaves should sleep in a more or less perfect manner at different seasons of the year. In regard to the Pandanus leaves, Mr. Darwin's view is that some leaves place themselves at night in a vertical position in order to escape being chilled and injured by radiation into the open sky.

The time is at hand for the renewal of subscriptions and the Gazette presents its claims among other botanical periodicals. In order to see its usefulness one has only to look over the index to Vols. V and VI, ready to be issued with the December number. In it will be found references to the descriptions of nearly 100 new species, over 40 of which are phænogamous, and two of these trees. Besides these there are many articles upon the physiology and histology of plants, some of them illustrated, and all of them useful. During the past year the Catalogue of the Flora of Indiana has been pushed

through to successful completion and is now in the hands of every subscriber to the GAZETTE. The list of contributors will at once be recognized as containing the leading botanists of this country. The circulation, although far from being what it should be, is constantly increasing, and subscriptions from all the colleges and laboratories of this country, and all the large herbaria and laboratories of Europe, assure contributors of the extensive publication of their articles.

Old subscribers have sometimes been slow in renewing their subscriptions and the first few months of a new year have generally been burdened by the mailing of back numbers. We wish it plainly understood that no number will be sent without orders, as it is not our policy to continue subscriptions and then collect.

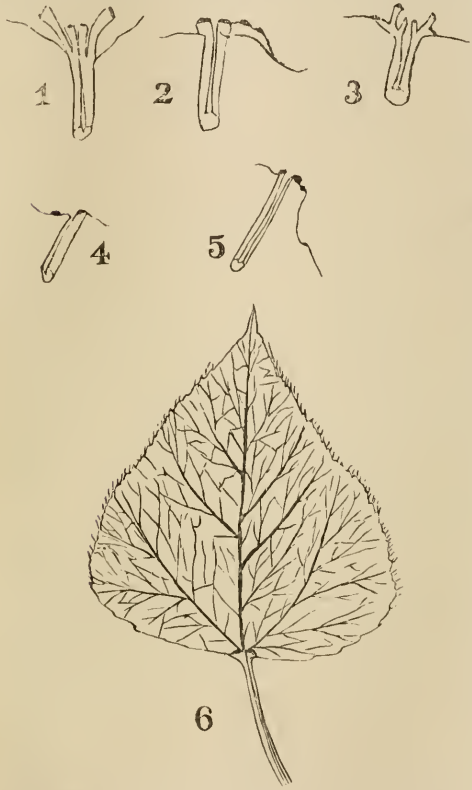
We have a confidence then that our friends will not only renew their own subscriptions, but will secure us many new ones for Vol. VII. We will be glad to mail a specimen number to any one likely to become a subscriber and we hope that our friends will send us the names of many such. Six years of constantly increasing success should so establish us in the confidence of the botanists of this country that they should give a liberal support. We ask this, not as a matter of charity, but as returning at least an equivalent for the very moderate subscription.

A new American Cynaroid Composite, by Daniel C. Eaton.—SAUSSUREA AMERICANA, n. sp.—Sparingly arachnoid pubescent, at length nearly smooth: stems two to three feet high, leafy: leaves 3 to 5 inches long, thin, broadly triangular-lanceolate, abruptly narrowed to a very short winged petiole, the lower ones sharply and coarsely toothed, the upper ones less toothed and gradually more truly lanceolate; heads 5 to 20 in a terminal corymb; involucres cylindrical-bell-shaped, 6 to 8 lines long, scales appressed, unarmed, webby-pubescent, the margins dark-colored; receptacle flat, naked; flowers about 15 in a head, one half longer than the involucre; achenia smooth; pappus exceeding the tube of the corolla, the inner bristles densely plumose, the outer gradually shorter and less plumose or merely scabrous; anther-tails ending in a fringe of slender hairs.

Mountains of Union Co., Oregon (7000 ft. elev.), W. C. Cusick, 1877. Cimcoe Mts., Washington Terr. T. J. Howell, Sept., 1880.

This fine species of Saussurea has at first sight something the look of a Vernonia, but the plumose pappus will at once distinguish it. *S. alpina*, of Northern Europe and Asia, occurs in British America, but is much lower than this species, is more tomentose, and has the leaves less toothed, longer petioled, and none of them so clearly triangular. *S. grandifolia*, Max., from the Amoor country, has a tall stem and triangular leaves, but it has also a densely chaffy receptacle, and belongs to a different section of the genus. Since the present is the only known exclusively American species of the genus, which is chiefly North Asiatic, the name here chosen is not inappropriate.—*New Haven, Sept. 30, 1881.*

The foliar nectar glands of Populus: by Wm. Trelease.—Early in May, 1880, my attention was drawn to a small aspen (*P. tremuloides*) by the actions of several green bees, belonging to the species known as *Augochlora pura*. At this time the tree was covered with newly expanded foliage; and the bees, flying busily from leaf to leaf, were evidently attracted by something and a moment's observation sufficed to show that they were engaged in collecting nectar, secreted by a double gland at the base of each leaf. These glands were placed on the upper surface of the petiole (Fig. 6) at its union with the blade, appearing, indeed, almost as if the petiole projecting above the upper surface of the blade had been abruptly cut down to the level of the latter, the truncated end being the secreting portion of the gland. Longitudinal sections of the glands showed them to have the structure usually found in members of the sort: the epidermis was transformed into a double layer of thin-walled elongated cells, forming the secreting surface just mentioned; and these cells, as well as the subjacent parenchyma, were charged with saccharine fluids. The homology of the glands, however, was not so readily determined. Each was more or less deeply bilobed and plainly consisted of two confluent glands, and from their similarity, in point of situation, to the



EXPLANATION OF FIGURES.—Fig. 1. Quadrifid gland from base of leaf of *Populus tremula*, var. *pendula*, enlarged.

Fig. 2. Glands from the same plant, borne upon the leaf-margin, enlarged.

Fig. 3. Branched glands from *P. monilifera*, enlarged.

Fig. 4. Base of leaf of *P. monilifera* having one gland displaced and borne on the margin, enlarged.

Fig. 5. Base of leaf of *P. trichocarpa*, showing the gradation of petiolar into serration glands, natural size.

Fig. 6. Leaf of *P. tremuloides*, showing the ordinary form of the double gland, natural size.

twin petiolar glands of various species of *Prunus*, which are known to be marginal outgrowths, representing the tendency to division which has produced the compound leaves of other *Rosaceæ*, it was at once inferred that the glands of *Populus* are of a similar nature; but since the *Salicaceæ* have simple leaves, analogy failed, and actual demonstration was apparently no very easy matter. An examination of other species, though at first yielding no satisfaction, finally solved the problem by affording several series of abnormal cases (Figs 1–5), in which the marginal nature of the glands was clearly shown. Thus, in a cultivated plant of *P. tremula*, var. *pendula*, the glands were found to be usually four in number and quite distinct, the outer pair rising on long stalks, the others being more nearly sessile (Fig. 1); but in one case (Fig. 2), instead of these there were several sessile glands, gradually diminishing in size, arranged along the margin of the leaf-blade—which, it should be added, is distinguishable in most of the species as a double ridge running down the top of the petiole. The paired glands of *P. balsamifera*, var. *candicans* are also quite frequently displaced, so as to terminate rather coarse marginal serrations; and illustrative cases were found in *P. monilifera* (Figs. 3 and 4), *P. ciliata*, *P. Sieboldii*, *P. suaveolens*, and *P. trichocarpa*, in the Gray herbarium at Cambridge. Finally small serration glands of the usual type grading into the petiolar glands, being found in *P. tremula*, var. *pendula*, *P. trichocarpa* (Fig. 5) and other species, left no doubt of the homology of the members in question with those of *Prunus*, *Ricinus*, etc., and their origin is in no wise different from that of the similar outgrowths found on the leaves of certain willows.

Observation showed that they do not occur on all of the leaves, but, as a rule, only on the first half dozen or less, which appear on each branch in the early spring; and in summer and autumn, these having fallen, it is sometimes possible to examine several branches without detecting a single glanduliferous leaf, on species which produce them abundantly earlier in the season.

With a view to ascertaining their prevalence through the genus, I examined such species as were found living; and, an opportunity offering, those represented in the herbarium of Dr. Gray, with the following results: In the typical *P. balsamifera* two separate glands were found at the base of the blade, and the serrations of the latter commonly ended in smaller, otherwise similar organs; and in the var. *candicans* the basal glands were always present, though those of the teeth were not so frequent. Those of *P. ciliata* were quite similar. On the broad leaves of *P. Euphratica* two small but well developed glands were found, but none were seen on the narrow leaves of the same species. *P. grandidentata* and *P. heterophylla* have well developed petiolar glands, and the latter has an abundance of serration glands. On *P. monilifera* and *P. angulata* the basal glands are present, and often stalked and divided (Fig. 3); in the larger leaves they are frequently of large size. In *P. pruinosa* they are large and prominent; in *P. Sieboldii* they are present and frequently remind one of those in *P. candicans*. In *P. suaveolens* they are large, and clearly belong to the leaf-

margin. In typical *P. tremula* they are usually quite similar to those found in *P. tremuloides*, though sometimes more widely separated. Some specimens of this species failed to show any glands; and a cultivated plant of the drooping variety was once examined in early May without the detection of a single gland, though at other times, these organs were found in abundance on the same plant. The glands of *P. trichocarpa* are quite variable, being sometimes large and close together, at other times, small and widely separated. I was never certain that I saw these bodies on *P. alba*, though they may sometimes occur as very small outgrowths concealed by the wool which is so abundant on the leaves. Small serration glands occur on *P. angustifolia*, and the lowest pair—corresponding, doubtless, to those found at the top of the petiole in so many species—are no larger than the others. On *P. Fremontii* very small glands were occasionally seen, but appear to be uncommon. In *P. nigra* serration glands are evident and the lowest pair much as in *P. angustifolia*. No basal glands were seen on the var. *dilatata*; nor were any found on *P. tomentosa*. It appears, therefore, that the greater part of the species examined possess two or more distinct or confluent, well formed glands, situated where the blade and petiole join; and in the few species where none were discovered, I am by no means sure that they may not occasionally be produced; for, as has been previously stated, a careful examination of a plant of the drooping *P. tremula*—which, by the way, was sent out by nurserymen as *P. grandidentata*, *pendula*—in early May, failed to show a single gland, but, a week or two later, after several days of rain, the young branches grew very rapidly for a short time, unfolding many new leaves, and the first three or four of these on each branch bore large and active glands.

Though of such frequent occurrence, these glands have been generally overlooked or considered of little value by systematic botanists, probably because of their limitation to the earlier leaves, and their occasional entire suppression. The elder Michaux, speaking of this genus[1], says: "Glandulæ basi foliorum nihil valent ad distinguendas species, quidpe quae, in eadem specie, aut desunt aut adsunt." In his descriptions of the species he mentions these organs only in *P. grandidentata*. The younger Michaux figures them in *P. angulata*[2] and *P. monilifera*[3] without making mention of them while they are figured and mentioned under *P. canadensis* (*P. monilifera*)[4]. Wesmael,[5] speaking of *P. Candicans*, says "Petiole * * * portant 2 glandes dans le jeune age." Bigelow[6] and Loudon[7] mention the glands of *P. grandidentata;* and Pursh[8] describes them in *P. lævigata* (*P. monilifera*), and *P. monilifera*. Loudon[9] also

[1] Flora boreali Americana, II, 243.
[2] Arbres, III Pl. XI; N. Am. Sylva, II, Pl. 94.
[3] Arbres, III, Pl. X; N. Am. Sylva, II. Pl. 96.
[4] Arbres, III, pp. 298, 299, Pl. XI; N. Am. Sylva II, p. 117, Pl. 95.
[5] Monographie de toutes les especes connues du genre Populus, 1869, p. 68.
[6] Plants of Boston, 1824, p. 370.
[7] Arboretum, III, p. 1650.
[8] N. Am. Flora, 1814, p. 618 and 619. [9] l. c. pp. 1655 and 1657.

speaks of their occurrence on the latter species, and Wesmael,[10] speaking of this species under its synonym of *P. Canadensis*, also mentions these bodies; and elsewhere[11] makes the following surprising statement: "Communement sur les feuilles des femelles on recontre deux glandes petiolaires tres-voisines de la base du limbe. Toutefois, ce caractere n'a rien de constant sur toute des feuilles d'un meme rameau, et quelquefois meme on les observe sur les feuilles de l'autre sexe." Pursh[12] also noted the glands of *P. trepida* (*P. tremuloides*). As I have said, the secreting and subjacent tissues in these organs are charged, while young, with syrup, the sugar being doubtless derived from the transformation of starch which is of abundant occurrence in the adjacent parenchyma. A study of glands at the beginning of their activity showed the process of secretion to be the following: The slight cuticle which covers the modified epidermis becomes separated from the balance of the cell wall, probably by the transformation of a thin layer of the latter into one of the gums, which by its osmotic power causes transudation of saccharine fluid from the interior of the cell. This constantly increasing quantity of fluid swells the loosened cuticle out in the form of a delicate bladder, which soon bursts and allows the nectar to appear on the surface. Evaporation is constantly going on, so that, if the plant is supplied through its roots with an abundance of water the cell wall separates a denser external, from a less dense internal syrup and a continuation of the osmotic action keeps up the secretion of nectar for a considerable length of time. At times the evaporation predominates, and crystals of sugar may then be found upon the gland, in a dense, uncrystallized syrup; at other times the secretion is so plentiful as to collect in drops which occasionally flow upon the surface of the leaf. Carefully washing the glandular surface with pure water always lessened its power of secretion, and, if repeated several times, so as to remove the last trace of sugar, completely prevented further activity. The addition of a small drop of syrup, however, always caused a renewal of the secretion, in glands which had been thus washed.[13]

Although the presence of apparently perfect glands was noticed in the species previously enumerated, I was able to prove their activity by examination of living plants only in *P. tremuloides*; *P. balsamifera*, *candicans*; *P. grandidentata*; *P. monilifera*; and P. *tremula*, *pendula*.

The nectar which accumulates at the surface of the glands is largely gathered by numbers of small insects, chiefly Hymenoptera and

[10] l. c. p. 63.
[11] l. c. p. 27.
[12] l. c. p. 618.
[13] These experiments, which appear to show conclusively the osmotic nature of the secreting process, were suggested by, and are but repetitions of, some of those performed by Dr W. P. Wilson in Pfeffer's laboratory, the results of which were communicated to the writer last winter, and have just been published in *Untersuchungen aus d. bot. Inst. in Tuebingen*, as I learn from an abstract of Dr. Wilson's article by Francis Darwin (*Bot. Zeitung*, 1881, p. 545).

Diptera. On *P. tremuloides* I observed the following visitors: *Augochlora pura*, *Selandria Rubi*, *Microgaster* sp., *Phytodietus vulgaris*, *Halictus* sp. (identified by Mr. Cresson), and numerous small flies which have not been determined, beside a multitude of ants, of which Mr. McCook kindly identified *Formica exsectoides*, *F. fusca*, *F. gagates*, *Crematogaster lineolata*, and *Dorymyrmex pyramicus*. The common two-spotted *Coccinella* was also frequently seen to feed upon the secretion of these glands. Many of these insects were also found upon *P. grandidentata* and *P. monilifera*, and in addition I noticed one species of *Andrena* upon the former. The first thing that strikes one in studying the insects which feed upon the extrafloral nectar of our poplars is their variety: —Coleoptera, Diptera, and both parasitic and imparasitic Hymenoptera are found, the most numerous being ants, and ichneumonid parasites. As is usual in such cases, the ants as a rule show a disposition to fight, rather than give up their places by the glands, over which they sometimes remain for hours; and some species are so pugnacious that the slighest jar to the branch upon which they are is sufficient to cause them to assume the offensive, and, with mandibles open, they rush about in search of the cause of the disturbance. On presenting my finger to them on such an occasion I have usually found them manifesting a sufficiently strong desire to bite it, but, as when in attendance upon aphides, they are not generally disposed to leave the plant. Whether it be on account of its greater quantity, or because it possesses a more agreeable flavor, I am unable to say, but the honey-dew of aphides is far more attractive to all of the ants observed than the nectar from extrafloral glands, not only in this, but in other genera of plants; and Belt[14] has found the same to be true of the honey dew of coccids. In 1880 the poplars about Ithaca, N. Y., were badly infested with plant-lice which I referred to *Chaitophorus populicola*; and it was noticeable that after these insects became established on a tree the ants, previously very abundant about the foliar glands, soon transferred their attention to the aphides, so that as a rule the only visitors to the glands were small bees, flies, and Microgasters. Besides the *Chaitophorus*, one other plant-louse was found upon the leaves of *P. tremuloides*, but it was not identified. Both these insects were found suffering from the attacks of some parasite, and large numbers were to be seen greatly swollen and either dead or dying. Observation showed that, in the case of the *Chaitophorus*, one of the Microgasters found about the nectar-glands of the plant was the cause of this; and several times one of the parasites, after feasting upon the secretion of these glands, was seen to begin a search for suitable candidates for its favor Carefully examining the aphides with its antennæ, as it moved through them, the Microgaster rejected all beyond a certain size, knowing that they would have reached maturity before its own offspring had attained its full development; but when one of the right age was discovered, her ovipositor was quickly brought forward under her body, and a single thrust lodged the egg

[14] Naturalist in Nicaragua, p. 225.

within the body of the victim, there to undergo its further development and transformations. These plant-lice were also destroyed in considerable numbers by the larvæ of the two-spotted lady-bird, which also feeds upon the nectar of the plant. Thus it appears that the secretion of nectar by extrafloral glands on poplars attracts to the plants many insects, of which at least three kinds—ants, ichneumonids, and lady-birds—are of benefit to them, the first rendering it unsafe for lepidopterous larvæ or other herbivorous insects to frequent the plant, and making contact with it undesirable for larger animals, while the other two destroy one of its insect enemies in large numbers.

After reaching maturity, the leaves of poplars are quite coriaceous and being for this reason less liable to attack than when younger, no longer require the protection secured by their glands; hence it happens that these organs are found actively secreting only on young leaves, and only on those produced early in the season, when the foliage, young fruit, and tender branches most require protection; and, being no longer required, they are not produced by the later formed leaves. A somewhat similar case is afforded by some of the *Smilaceæ*, where Prof. Delpino[15] has shown that the young plants are protected by a bodyguard of ants, maintained by the production of nectar by foliar glands, while the older plants, being protected against grazing animals, etc., by their thorns, have no glands.

Some light is thrown on the conditions upon which the development of these organs depends, by the drooping aspen already mentioned, turgidity and active growth being evidently the immediate requisites; but the primary reason for their existence, bringing in the much-vexed questions, of heredity and first causation, is not so easily cleared up. On the whole it appears probable that these organs are protective, as those of *Passiflora*, *Gossypium* and other plants are supposed to be; and we have been able to show that this protective function is, at the present time and in our own climate, of some positive value.[16] It is not unlikely, however, that in the Cretaceous and Tertiary periods, in the youth of the genus, protection was far more needed than now, and these glands may then have been efficient in maintaining upon the plant a body-guard of pugnacious ants that served to repel other species which, like the leaf cutting ants against which *Pteris*, *Acacia*, etc., are now similarly protected in tropical America, would have been very destructive to the plants if left to themselves.

It having been suggested that the glands of *Populus* may have been of great use in the earlier geological ages, the question naturally

[15] Atti R. Universita di Genova, IV, Pt. I, p. 26.

[16] Although of considerable protective value to-day, these glands by no means prevent the plant from suffering defoliation at times. I recollect seeing the cottonwoods (*P. angulata*) almost entirely stripped of their foliage in Alabama in May, 1879, by a chrysomelid beetle, *Plagiodera scripta*. Knowing nothing of the leaf-glands at that time, I can not say whether they were actively secreting; but I do not recollect seeing ants about the trees, and as I was then carefully studying phenomena of this sort, their presence would scarcely have gone unnoticed.

arises whether they have not been preserved in fossil leaves. From their occurrence on so small a percentage of the leaves, this is less probable than in many other plants where glands are produced the season through; and an examination of such specimens and figures as I had access to failed to show me a single instance of their preservation. Prof. Lesquereux, however, writes me that they are of regular occurrence in varying numbers and position, on the tertiary *P. glandulifera* Heer; in which they have been figured by Heer.[17] Whether this is an autonomous species, or merely based on the early, glanduliferous leaves of some other species, I am unable to say, but one might almost expect the latter to be the case.

A Large Puff-Ball.—On the morning of October 18 some unknown friend placed in my yard a specimen of the Giant Puff-ball (*Lycoperdon giganteum*), which had attained unusual proportions during the long continued rains. It was depressed-globular, its circumference in a horizontal plane being fifty-eight inches, and the line reaching from the ground on one side over the top and down to the ground again was thirty-two inches. In Mr. Peck's "U. S. Species of Lycoperdon," I find but one larger specimen noted, and that was over eight feet in circumference, unless those mentioned by Schweinitz may have been larger —J. M. C.

Alopecurus saccatus, n. sp.—Culms 5 to 10 inches high, erect or slightly geniculate below, simple; the radical leaves short, cauline about 3, the lower sometimes extended into a long filiform point, upper ones short, the sheath inflated and generally enclosing the base of the panicle; upper ligules deltoid, acute, about 2 lines long; panicle spike-like, oblong, 1 to 1½ inches long, comparatively loosely flowered; spikelets 2 lines long, the outer glumes narrowly oblong, obtuse, scarious at the apex, slightly united at the base, lateral nerves obscure, the keel and margins fringed with silky hairs, otherwise nearly smooth; flowering glume (lower palet) oblong, obtuse, smooth, equaling the outer glumes, the margins united more than half the length, forming a sack and enclosing the oblong seed which is one tenth of an inch long; awn stout twice or thrice as long as the glume, inserted near the base; spikelets about 60 on an inch of the panicle.

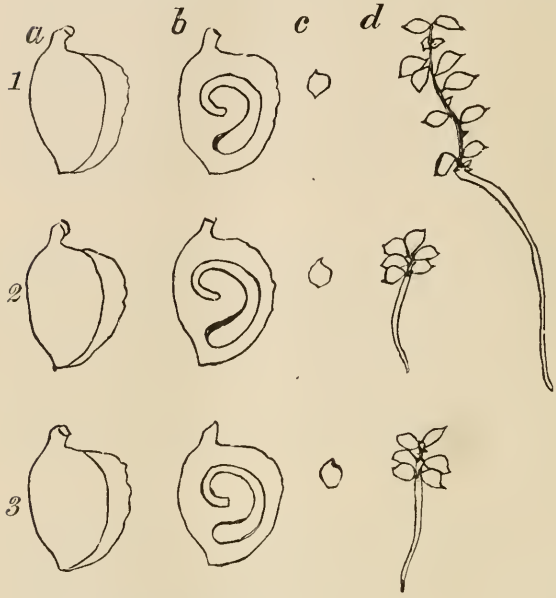
This species is remarkable forthe large size of the spikelets, and for the saccate flowering glume. Found in Eastern Oregon by T. J. Howell. —Geo. Vasey.

Potamogeton Hillii, n. sp.—This plant, a fragment of which I noticed in the collections of the Phila. Acad., without name or locality given, and a few specimens of which are among the miscellaneous sheets of Dr. Robbins, and named by him provisionally, P. *pauciflorus*, larger form," now proves to be a distinct species.

Imperfect specimens, sent by Rev. E. J. Hill, were noticed in this Journal for May, 1880, as a possible var. of *P. zosterifolius*, and

[17] Flor. foss. Helvet. II, Pl. LVIII, f. 5–10.

its habitat is described by Mr. Hill in the number for Sept. 1881. Excellent specimens, obtained in Aug. 1880, by Mr. Hill, at Manistee, Michigan, have been sent to England for comparison with the forms at Kew and London, and have also been compared with all our known American forms, with the result above stated. It is now named for Mr. Hill who has done so much for its elucidation.



1. P. zosterifolius, Schum.
2. P. acutifolius, Link.
3. P. Hillii.

Stem about 1 foot in height, slender, widely branching. Leaves all submerged, linear, acute, 1–2½ inches long and ½–1¼ lines wide, 3-nerved, the lateral nerves delicate and nearer the margins than the midrib, the midrib often compound below, stipules free, whitish, striate, obtuse, 3–5 lines in length. Peduncles short, spreading or somewhat recurved, more or less clavate; spikes capitate, 3–6 fruited. Fruit obliquely obovate, about 1¾ lines long by 1⅛ lines broad, tricarinate on the back, the middle keel more or less undulate, compressed on the sides, the front slightly arched, obtuse at base; style nearly facial, short, recurved; embryo apex pointing transversely inwards.

New York and Michigan, August.

In general appearance similar to *P. pauciflorus*, but allied by its fruit to the *zosterifolius* group, and especially to *P. acutifolius*, Link., which it greatly resembles in the spikes and fruit.*—THOMAS MORONG.

*The above figures, drawn from specimens in my possession, will serve to show the similarity between the spikes and fruit of the three species above mentioned. In all these cases the dorsal keel is undulate on the margin: it is sometimes distinctly toothed or entire. It should be said, also, that while the common form of the nutlets of *P. zosterifolius* and *P. acutifolius* is shown, the European specimens often have a sharp projecting angle on the face, about one-third of the distance from the base, a peculiarity which I have not observed in the American *P. zosterifolius* or *P. Hillii*.

a. nutlet much magnified; *b*. embryo of the same; *c*. natural size; *d*. fruit spike.

HERBA
NEW YORK

Botanical Gazette.

Vol. VI. DECEMBER, 1881. No. 12.

Editorial.—Mr. Thos. Meehan, in the *Gardener's Monthly* for November, gives a very interesting history of the weeping willow. All sorts of stories about it have found their way into print and it is well to have them corrected.

C. V. Naegeli, in a recent number (Oct. 14) of the *Botanische Zeitung*, has published a paper on "The Growth of the Starch-grain by Intussusception." It will be read with great interest by all interested in this much vexed question.

Dr. DeCrespigny, in the last *Science Gossip*, speaking of plants from the Swiss Highlands, says that "Desor reports *Ranunculus glacialis* as growing upon the Schreckhorn at 11,600 feet, *Androsace pennina* at 10,550 feet, and the lichen *Parmelia elegans* on the highest summit at 13,050 feet."

Prof. Pfeffer has published his first volume on the "Physiology of Plants," it being devoted to Stoffwechsel or metabolism. The second volume will be upon "Kraftwechsel," which, Mr. Vines says, is the conversions of latent into kinetic energy and *vice versa* which are involved in the metabolic processes.

A late copy of Nature says that Herren Loew and Bokorny find that living protoplasm possesses in an eminent degree the property of reducing the noble metals from solutions, and that this property is lost when death occurs. The discoverers of this fact say: "It may well be inferred that the mysterious phenomenon denoted by the name of 'Life' depends essentially on these reducing atom groups In the present state of science we explain these 'groups in motion,' these springs of life phenomena, as aldehyde groups, but would by no means exclude some different and better mode of explanation."

Dr. Arthur Minks is engaged in a most extensive work. Having established, as he announces, the exact line of demarcation between Lichens and Fungi, he proposes to take them up species by species and show the exact position of each, claiming that many so-called fungi will find a resting place among lichens. This book will be issued in yearly parts, each to treat of at least 200 species. The first volume is to appear this month and can be procured from any bookseller in Germany. The decisive characters employed are based upon the thecæ. To quote from the prospectus. "The two organs, the theca of Lichens and that of Fungi, are so essentially different, that they can not properly be compared; for considering their structure and evolution, they with their spores, stand in a more striking contrast than any other in organic nature."

Mr. Lester F. Ward has had a paper published in the proceedings of the Phil. Soc. of Washington entitled "Field and Closet Notes on the Flora of Washington and Vicinity." It is a most exhaustive consideration of the subject and may well serve as a guide in the study of other floras. In a comparison of the flora of 1830 with that of 1880, Mr. Ward makes it appear that over 80 species have actually disappeared from the region in that time, or have become so rare that their stations have not been discovered. If these represent only the observed disappearances, probably the actual number is much greater. A detailed description of localities of special interest to botanists is given and they make one's fingers twitch to be collecting such species as are mentioned. The flowering time of a large number of species has been especially noted as the time in the region studied does not accord with that given in the manuals, being usually several weeks earlier. Second or fall-blooming of vernal species was noted in 17 species, the majority being *Gamopetalæ*. Seven well defined albinos are listed the genera being *Desmodium*, *Liatris*, *Rhododendron*, *Vinca*, *Mertensia*, *Sabbatia* and *Pontederia*. Many tables are given which give statistical views of the Flora from various standpoints. The whole number of species is 1,249, which compares very favorably with the floras of much more extended regions.

Dr. William Siemens during last winter and spring repeated and enlarged upon his experiments of the year before, showing the applications of electric energy to horticulture and agriculture. His previously stated results were largely confirmed, and it seems to be no longer a matter of doubt that electricity will become as important a factor in horticulture as heat and water, whenever its production can be made reasonably cheap. The favorable effect of continuous light is re-affirmed, and plants seem to be able to work unceasingly and the beautiful nyctitropic actions, so elaborately worked out by Dr. Darwin, are more from the absence of light than from the need of rest, and might well be dispensed with if light could be supplied uninterruptedly. Thus development from "the early leaf to the ripened fruit" can go on at a greatly accelerated pace, and not only will the resulting seeds not lose any germinating power but the fruit will gain in size, aroma and color.

Prof. W. J. Beal has just published an excellent lecture upon "The New Botany," being a consideration of the best method of teaching. The lecture is one that should be in the hands of every teacher of botany, so full is it of suggestions that can be acted upon, even by those who have no laboratory appliances. The whole effort of the method given is to cultivate in the pupil just what many of us have long been struggling after, namely, the ability for original research. No matter what method of teaching botany is employed, if it teaches and stimulates the pupil to observe, it is based upon the correct principle. There may be as many ways of gaining this end as there are good teachers, and every true teacher will leave his own impress upon the method employed. But those who can not originate methods, had better follow

those that have proved most successful, and looking at results, there are few better teachers of botany than Prof. Beal. But he speaks for himself upon another page and gives us not only a synopsis of his own methods, but, what is perhaps just as interesting, a specimen of what they produce.

EVER SINCE INSECTIVOROUS PLANTS came into vogue there has been no end of plant marvels. That wonderful tropical tree which swallowed into its leafy crown any unlucky mortal who came within the circle of its influence has run the gauntlet of the newspapers more than once, but really it represented very wel la Broddignagian *Drosera*. The latest phase of this multiform story has just appeared in the pages of a scientific periodical where it is published as credible. It comes this time dignified by the names of officers of the royal navy, and the appetite of the tree has become most abnormal, desiring now only bones which it holds on to with all the pertinacity of a famished dog. The tree observed had the habit of passing the bones tossed under it up to its upper braches, and standing near some native huts every twig was ornamented with its set of bones, the natives evidently not considering it so much of a curiosity as a convenient receptacle for bone rubbish. Indeed, this last story seems not to have lost a whit of the marvels of the first; and its appearance in a prominent scientific journal will give it a fine start in the unscientific press.

The Asparagus for Histological Study.—I have for several years been wanting a good Monocotyledon for histological study in the botanical laboratory, one which should be for its sub class what the pumpkin is for the Dicotyledons. The Indian Corn, which is commonly used, is too difficult, and too greatly specialized a type, exhibiting as it does the peculiar nodal structure of the stem of the Gramineæ, rather than the structure of the stem of Monocotyledons in general. A good representative stem, and one which can be obtained everywhere in good condition, from early spring until the end of the season, is the Asparagus. This has been carefully studied the past season in the botanical laboratory of the Iowa Agricultural College, by Miss Fannie J. Perrett, from whose thesis I select the following results :

The epidermis is composed of elongated cells quite regular in outline, and of deep radial, as compared with tangential diameter. The external walls are well thickened. The stomata are abundant, and are regularly disposed. They appear to develop directly from mother-cells cut off by transverse fission from the ends of ordinary cells. It is an easy matter to secure transverse sections of stomata by making repeated cross sections of the stem. Trichomes appear to be wanting.

The hypoderma is composed of collenchyma and parenchyma, the latter being rich in chlorophyll Beneath the hypodermal tract is a meristem layer, to be more particularly noticed hereafter. The remainder of the Fundamental System of tissues is composed of large and long-celled parenchyma.

The fibro-vascular bundles are closed; that is, they contain, when fully developed, no meristem tissue. In a transverse section

each bundle consists of a V-shaped mass of tracheary tissue, including spiral, reticulated and pitted vessels, the last mentioned occupying the upper parts of the arms of the V, others lying towards its point. The cavity of the V, which looks toward the periphery of the stem, contains a poorly developed sieve tissue. Small-celled parenchyma on its peripheral and lateral surfaces, and a varying amount of fibrous tissue, mostly in connection with the tracheary tissue, complete the structural elements of the bundle.

In the meristem layer mentioned above, new bundles arise, and thus increase the stem in a sort of exogenous manner, as is done in the Dragon trees and other tree-Liliaceæ. This feature alone in the structure of the Asparagus stem makes it an exceedingly valuable one for study, as bundles of all ages may readily be obtained in the same section.

In the stem at the base of each leaf, those ascending bundles which are connected with the fibro-vascular system of the leaf, divide into four branches, two of which continue upward through the stem, while two pass outward into the leaf. In each bundle, the ascending cauline portions unite right and left with corresponding portions of the adjacent bundles, while in a similar manner those which pass into the leaf unite right and left, and form the principal leaf veins. The bundles in the stem which connect with the fibro-vascular system of the lateral stems (branches) divide at the baseof the latter into two parts, which unite right and left and thus form the bundles of the lateral stem. A few of the branch-bundles have a deep connection in the stem with bundles which have also an upward cauline extension.

It must not be forgotten that the leaves of the Asparagus are quite small, flat, triangular, bract-like structures, and that the needle-shaped bodies which constitute the so-called leaves, are in reality short, leafless, lateral stems.—C. E. Bessey, *Ames, Iowa.*

An Interesting Fernery.—My attention having been called to some ferns growing in the crevices of the north wall of the old Mass. State Prison in Charlestown, (no longer used as a prison) by Mr. C. E. Perkins of Somerville, on examination I found four species which I have identified as *Asplenium Filix-fœmina*, *Dicksonia pilosiuscula*, *Aspidium Thelypteris* and a form of *Aspidium spinulosum*.

The plants, with the exception of one growing high up beyond my reach, but the fronds of which I afterward obtained with the aid of a long pole and found to be a well fruited specimen of *A. Filix-fœmina*, were, as might be expected in such a situation, merely depauperate forms and mostly sterile.

I collected a few fertile fronds of *A. Filix-fœmina* that might very well pass for "*var. exile*," some of them not more than 4 or 5 inches tall and sparing, one or two quite well pointed.

The other species were all sterile, and the specimens, except those of *A. spinulosum*, were not at first clearly distinguishable being small

and considerably changed in appearance by growing in such uncomfortably cramped quarters.

As none of these ferns, nor any others for that matter so far as I know, grow anywhere near the Prison grounds naturally, their presence in such an unnatural situation is not easily accounted for, but it is to be presumed that the spores were blown from a distance by high winds and lodged in the crevices where they subsequently found sufficent moisture and shelter to favor their germination.

The territory immediately surrounding this portion of the Prison wall at present (originally partly surrounded by water) is made of low filled land partially covered with coarse plants, which I had no time to examine, but conspicuous among which, and abundant, was *Senecio vulgaris*, and, judging from the number of burrs attached to my clothing when I came off the ground, *Lappa officinalis*.

The ground still retains much of its original dampness, and this, together with the condensation of escaping steam from the manufactory adjoining the wall within the Prison yard, assists the heavy granite wall in condensing and holding moisture enough to sustain quite a vegetable colony, other plants besides ferns being found there.

Some of the upper cracks had become sufficiently widened by the crumbling away of the mortar to effectually hide and protect the sparrows that flew in and out above my head, and this may have led one near by to suggest that the *seeds of the ferns had probably been carried there by the birds*!

The rootstocks of *A. Thelypteris* and *Dicksonia* had receded to quite a depth, while the crowns of the others were about even with the wall.

I brought away a few plants that I succeeded, with some difficulty, in getting out of the cracks, and also *Marchantia polymorpha* that was growing with them, and these I have set out in a moist ravine where I can watch their future development under more natural conditions.

Mr. Perkins, who has botanized quite extensively about waste grounds, and is familiar with all such places in this vicinity, writes me that he saw one season a large fern clump growing on one of the wharves in the Charlestown Navy Yard partly under the beams, and mentions some ice-houses with ferns growing from the cracks between the boards, but the latter are in close proximity to fronds whose ferns abound naturally.—GEO. E DAVENPORT.

Some New Grasses.—MELICA HALLII, n. sp.,—Culms wiry, erect, 1½ to 2 feet high. Leaves all involute, setaceous, scabrous; the radical numerous, 5 to 12 inches long, those of the culm (about two) 1 to 1½ inches long, ligule obsolete. Panicle narrow, 2 to 3 inches long, the branches solitary or in pairs, the longest 1½ to 2 inches, the 3 to 5 spikelets borne above the middle. Spikelets 3 to 4 lines long, two-flowered with a distinct rudiment of a third: outer or empty glumes membranaceous, equalling the flower, lanceolate, acute, the upper a little the longer, midvein prominent, the lateral nerves soon evanescent or wholly wanting; flowering glumes and palets chartaceous, finely scabrous, about equal, the flowering glume 3–5-

nerved, the midnerve terminating in a short, stiff mucro, the palet strongly 2-nerved and bifid or 2-cleft at the apex. Stipe of the second flower about half a line long.

This I have received from Mr. J. Macoun, collected three different seasons on the Great Plains of British America. It is also the No. 621 of Hall and Harbour's Colorado collection.

SPOROBOLUS JONESII, n. sp.,—Culms densely tufted, erect, 1 to 1½ ft. high, wiry; radical leaves numerous, short, rigid and involute, except the lowest; culm with 1 or 2 leaves below, the blade about 1 inch long, setaceous, sheath four times as long, scabrous. Panicle erect, thin, 1½ to 3 inches long, rays solitary, appressed, the lower 1 to 1½ inches long, subdivided from the lower third; spikelets mostly very short pedicelled, about 1½ lines long; glumes about ⅓ as long as the flower, broad, obtuse or truncate, and the apex erosely toothed, thin and purplish; flower with a distinct pedicel or callus, the flowering glume and palet much alike in texture, firmly membranaceous, 1 nerved, finely scabrous and slightly pubescent below, 1 to 1½ lines long, the palet narrower and but little shorter, after flowering becoming more elongated, cylindrical and pointed.

Collected by Prof. M. E. Jones at Soda Springs, Cal.

POA PURPURASCENS, n. sp.—Culms erect, 1 to 1½ feet high, smooth; cauline leaves mostly 2, the lower ones 2 or 3 inches above the base, the upper with a long sheath running above the middle of the culm, blade flat, 2 to 3 inches long, thickish, pungently pointed, 1½ lines wide, ligule about 2 lines long, membranaceous, entire or incised, sheath and blade glabrous; panicle erect, oblong or pyramidal when expanded, 2 to 3 inches long, rays in twos or threes, single above, an inch long or less, mostly flowering above the middle, each with, usually, 2 or 3 spikelets. Rachis, rays and pedicels glabrous. Spikelets ovate, about 4 lines long, short pedicelled, 3 to 5 flowered; outer glumes broadly scarious margined, the lower about 2 lines long, ovate-lanceolate, acute, the upper a little longer and wider with the apex coarsely toothed, or entire and acute, 3 nerved at the base; flowering glumes 3 lines long, lanceolate, compressed, with a wide scarious and purplish margin and apex, sometimes lacerate toothed, mostly acute, the lower part green, minutely scabrous, and near the base pubescent or villous: palet a little shorter, narrow, 2 keeled, scarious and colored at the apex. Panicle and lower leaves and sheaths purplish.

Collected by Mr. Howell on Mt. Hood, where it was also collected by Mr E. Hall, Oregon Coll. No. 633. It has also been collected in the Yellowstone region.

Mr. Howell's collection contains specimens of the grass which has been called *Poa*, and more recently *Atropis*, *Californica*. In the Botany of California the genus *Atropis* is made to include not only several species which have been classed in *Glyceria* and *Sclerochloa*, viz: *Glyceria distans*, *tenuiflora*, *convoluta*, *airoides*, *maritima* and *procumbens*, but also Mr. Nuttall's two species *Poa tenuiflora* and *P. Andina*, as well as two species described there for the first time. Any one acquainted with these grasses will perceive that in order

to bring them together considerable modification of the characters of the genus *Sclerochloa* of Beauv. and of *Atropis* as defined by Trinius must be effected. Inded I do not think this can be accomplished with reference to Nuttall's *Poa Andina* without separating from *Poa* a species which as naturally belongs there as does *P. alpina*. With respect to the plant generally known as *Poa tenuifolia*, Nutt., especially if we include the larger California forms there is a wonderful variation in nearly all the characters usually defined in the limitation of a species, namely, in the height of culms, the length and rigidity of leaves, both radical and cauline, the size of ligule, the size and form of panicle, the length and spread of the rays, and to some extent in the size and form of the flowering parts. From a very careful study of hundreds of specimens I conclude that this species or group of species is essentially characterized by linear, linear-oblong or linear-lanceolate flowering glumes, of a hard or firm texture, minutely scabrous, convex or rounded on the back, and with the apex and more or less of the margins scarious and peculiarly tinged with a yellowish bronze color. The apex of the flowering glume may be acute or obtuse, entire or erose. In *Poa Andina*, Nutt., as I understand that species, the flowering glumes are broader, generally thinner in texture, less scabrous, smooth or softly and sparsely pubescent, keeled and generally much compressed, in some forms quite as much compressed as in *Poa alpina*.

Usually *Poa tenuifolia*, has *long, narrow* outer glumes, sometimes quite equalling the flowering ones in length; usually *Poa Andina* has shorter and broader outer glumes. In my consideration of *tenuifolia* I have included the large California forms, one of which I some years ago described as *Festuca Oregona*, (see BOT. GAZETTE for August 1877) and which I now return to *Atropis Californica* on the authority of Gen'l Munro, to whom I sent specimens which were returned to me with his name as above and with synonym *Sclerochloa Californica*, Munro in Pl. Hartw. I particularly state this because in the Botany of California, Gen'l Munro's name is applied to the *Poa Andina*, Nutt. It is not probable that Gen'l Munro has seen all the forms of the two plants, but in view of their variability he may have even confounded the two. In the species, or group of species, which I have taken for *Poa tenuifolia*, Nutt., or *Atropis Californica*, Munro, there is such a perplexing variety of forms that it may well be conjectured that Nature is now engaged in the work of differentiation, and that in process of time the lines will become more sharply defined and several new species established.

GEO. VASEY.

Systematic Botany Nevertheless.—

"The reason why I can not tell,
But this alone I know full well,
I do not like you, Dr. Fell."

And here the average amateur, interested in his local flora, and fond of dabbling a little in systematic botany, had better, perhaps, take his stand, when urged to study vegetable histology and physiology instead. And yet, when you find that a very large proportion of those who constitute the purchasers of botanical books (a very useful

class to the Big-wigs) and the subscribers to botanical periodicals (use understood) are interested in plants themselves, and not in their "Latin parts"—parenchyma, collenchyma, sclerenchyma and all the rest—interested in their structural affinities as expressed in a methodical arrangement, in their geographical distribution and antecedents, there must be some reason for it. For ever since the day when some of us pulled through the first two hundred pages of the earlier edition of Gray's Text book (if the "term" had been longer we might have gone further with our memorized recitations) down to the present era of Summer Schools all given over to the study of protoplasm, we have had class after class ground through this course of Histology, rarely under the most efficient guidance, and oh! how abundantly under the perfunctory charge of the average High School teacher, and as a patent commentary on the outcome of it all the editor of this delightful GAZETTE of ours asking the "physiological botanists of this country" to take in a "hearty way" "half of its space," but they "are either few in number" or else "do not record their investigations" Meanwhile systematic botany, *practically* ignored in our schools, (I measure my words and speak from a tolerably extended observation) needs no noise of the "recruiting sergeant" to keep its ranks full! Prof. Morse in his charming preface to the "First Book of Zoology" says,—"to collect in the field, to make a cabinet, and then to examine and study the specimens collected are the three stages that naturalists, with few exceptions, have passed through in their boyhood." "The way to commence the study of Zoology (and Botany as well) is to follow the course one naturally pursues when he is led to the study by predisposition." I have not a word in disparagement of the importance of histological studies, nor of the interest that may be found therein by persons who have an aptitude for such investigations. What I do protest against is the way in which Histology is thrust upon students as *the only* foundation for a fair knowledge of systematic botany. It is assumed that a course of nice, microscopical work in cell structure is a capital preparation for the enjoyment which the average amateur seeks to find in the study of plants. This I am willing to half admit but, oh! the unutterable stupidity of simply memorizing the account of it all which is the fate of ninety-nine out of one hundred of the students who will "take botany" in their course "next term."*

After all, the choice is a matter of predilection. From the amateurs like John Stuart Mill and Charles Kingsley—men of transcendent ability, who seek in the amiable science recreation for a summer's vacation, or an occasional holiday, down to the young man or young woman of the obscure village, who is striving to keep mind and heart sweet and pure by "considering the lilies of the field" (I concede my physiological friend that the rest of the quotation is against me) it is a noticeable fact that systematic botany has the preference There is a hearty enthusiasm among field workers which is infectious; a generosity in sharing spoils which makes "a good find" half a disappoint-

* "The system I repudiate is that which allows teachers who have not come into direct contact with the leading facts of a science to pass their second-hand information on."—*Huxley.*

ment withal if there are not specimens enough to go 'round; and all this leads to correspondence, and thus furnishes the "key to the intercourse of most amiable minds." 'To botany," says Sir James E. Smith in a letter to the Rev. Dr. Muhlenberg, "I owe friendships and connexions I else could have had no chance of forming."

An argument brought forward by your excellent contributor, Prof. Rothrock, is in effect (I quote from memory) that Torrey and Gray, Engelmann and Watson have so worked up *for good* our North American Flora that there is nothing worth considering left to be done in that direction by their successors. The introduction of Mr. Sereno Watson's name, most appropriate as a matter of fact, is unfortunate for the argument. How many of us knew of Mr. Watson even by name before the publication of the "Botany of the 40th parallel" and since that time how he has been straightening out *Lupinus*, *Œnothera* and *Potentilla* and our Chenopods, &c., eliminating right under our very noses such species as *Ranunculus ambigens* and *Polygonum Muhlenbergii*, while the rest of us might have drifted along under a hazy impression that Torrey and Gray and Engelmann had worked that ground all over and there was nothing left worth gleaning. Just think how the Flora of the British Islands has been elaborated, and with what sustained enthusiasm it is still studied! What works of supererogation, pure and simple, are Bentham's "Hand Book" and Hooker's "Student's Flora" if we are to accept the view that the dictum of any systematist, no matter what his rank, is final. Again who is to be the botanical geographer of the American Flora as the recently deceased Hewit C. Watson was of the British, above all who is to collect the data upon which his generalizations are to rest!

I fear our friend Dr. Rothrock is indulging in a bit of covert flattery when he tells us to find encouragement in what Darwin got out of the study *Drosera*. Do we not all know too well that back of Darwin's brilliant success lies a sagacity in questioning nature and in appreciating the full significance of the response wholly phenomenal, and that one of us might make and write down observations for a lifetime, as utterly barren of important result as an undigested weather record.

But there is room for all. We need not crowd or jostle each other. Only let us hope that when Prof. Rothrock comes to establish that School of Botany for which he is so well equipped, not only by training at home and abroad, but that rarer qualification, personal magnetism, that he will make the critical study of a few forms but the first step toward the comparative study of many forms. The description of *a plant* with some such facile help as a printed schedule affords is one thing, the description of *a species* flexible enough to include varying forms is, so far as the exercise of one's wits is concerned, quite another thing, and the study of species in groups, discriminating for one's self without hint or help from those who have gone over the ground before, *this* has in it an educational value of the highest import, and prepares the student for much critical and independent work a field which yet remains to be done in our home flora.

— EMESBY.

A Comparative View of the Flora of Indiana.—A recent paper by Mr. Lester F. Ward, entitled "Field and Closet Notes on the Flora of Washington and Vicinity," has suggested the filling in of some of his tables with similar statements in regard to the flora of Indiana. I use, without verification, Mr. Ward's estimates of the flora of the Eastern United States, being the region covered by the Manuals of Drs. Gray and Chapman, and give in the first table the sixteen largest orders in the Flora of Washington and vicinity, in the flora of the Eastern United States, and in the flora of Indiana, the sixteen being arranged in the order of their importance. For convenience, Mr. Ward's list will be headed D. C. :

D. C.	*E. U. S.*	*Ind.*
1. Compositæ	1. Compositæ	1. Compositæ
2. Gramineæ	2. Cyperaceæ	2. Cyperaceæ
3. Cyperaceæ	3. Gramineæ	3. Gramineæ
4. Leguminosæ	4. Leguminosæ	4. Leguminosæ
5. Rosaceæ	5. Filices	5. Labiatæ
6. Labiatæ	6. Labiatæ	6. Rosaceæ
7. Cruciferæ	7. Rosaceæ	7. Scrophulariaceæ
8. Scrophulariaceæ	8. Scrophulariaceæ	8. Liliaceæ
9. Filices	9. Ericaceæ	9. Filices
10. Ranunculaceæ	10. Liliaceæ	10. Ranunculaceæ
11. Ericaceæ	11. Ranunculaceæ	11. Cruciferæ
12. Cupuliferæ	12. Cruciferæ	12. Orchidaceæ
13. Orchidaceæ	13. Orchidaceæ	13. Polygonaceæ
14. Liliaceæ	14. Umbelliferæ	14. Umbelliferæ
15. Polygonaceæ	15. Polygonaceæ	15. Caryophyllaceæ
16. Umbelliferæ	16. Cupuliferæ	16. Ericaceæ

It will thus be seen that the flora of Indiana is more normal than that near Washington, and that, omitting the *Filices* and *Ericaceæ* (our most poverty stricken orders) the second and third lists correspond with great exactness. These lists alone would indicate some unusual conditions in the vicinity of Washington, and such we find in the blending of the floras of north and south, as indicated by Mr. Ward. In comparing the first list with the third we notice that the *Liliaceæ* rise from the 14th place to the 8th, the *Cupuliferæ* drop out entirely, being the 17th in order of importance; the *Caryophyllaceæ* come into the first 16; and the *Ericaceæ* drop from the 11th place to the 16th. Mr. Ward shows that his local flora is richest proportionally in the *Cupuliferæ*, *Rosaceæ* and *Cruciferæ*, and poorest in the *Filices* and *Leguminosæ*. The *Cupuliferæ*, in fact, form the greatest peculiarity of the flora, containing as many as 58 per cent. of the species occurring in the whole of the Eastern part of the United States. The Indiana flora, compared with the same standard, is richest in the *Rosaceæ*, *Polygonaceæ* and *Cupuliferæ*, but none of them so abnormally represented as the *Cupuliferæ* near Washington, the *Rosaceæ* rising to but 48 per cent. The abundant *Cruciferæ* of Mr. Ward's list, in Indiana yield in importance to the *Liliaceæ*, *Ranunculaceæ* and *Labiatæ*, and just equal the *Orchidaceæ*. The Indiana flora is proportionally poorest in the *Filices* and *Ericaceæ*.

Comparing the 15 large genera listed by Mr. Ward with the

same number found in the Indiana flora, and arranging as before in the order of importance, the result is as follows.

D. C.	*Ind.*
1. Carex	1. Carex
2. Aster	2. Solidago
3. Panicum	3. Aster
4. Solidago	4. Polygonum
5. Quercus	5. Viola
6. Polygonum	6. Quercus
7. Desmodium	7. Desmodium
8. Salix	8. Helianthus
9. Juncus	9. Salix
10. Viola	10. Juncus
11. Cyperus	11. Panicum
12. Ranunculus	12. Ranunculus
13. Eupatorium	13. Euphorbia
14. Helianthus	14. Cyperus and Potamogeton
15. Asclepias	15. Galium and Scirpus

It will be noted that in the second list *Eupatorium* drops out, appearing in the Indiana flora as No. 25; *Asclepias* also drops out, being No. 20; *Panicum* drops from 3 to 11, and *Viola* rises from 9 to 5. It would seem that *Panicum* is the characteristic genus of the vicinity of Washington, while no single genus can be so ranked in the flora of Indiana, *Helianthus*, *Euphorbia*, *Viola* and several others being equally characteristic.—J. M. C.

Beginning Botany.—I want to tell you a little about my mode of teaching botany to beginners. Before long I will send you a copy of a lecture on this subject.

I set a student on the very start to studying some natural object, as a plant, a seed, a flower, a vine. He is asked to state to the class on the following day what he has discovered. One of the first points is to teach him to see and to become reliable and independent. To acquire this habit he is set to looking. To help him he is often asked to compare two branches of different trees, or two flowers of different species or genera, or two seeds or fruits.

I require students to write out more or less their observations. For this work credit is given, as well as for class recitations. This is not only done in the botany class, but our Professor of the English language, finds such topics among the best he can select for the practice of young students. Many of the essays required are accompanied by drawings which help to explain certain points. As an example of this work, I send a short paper prepared by a member of the Freshman class. It must be remembered that he is a beginner; that he used no books, but went to the plants to get his facts. He had been studying plants for a few weeks. He had been referred to an elementary book for some names. He had received some hints on some points from his teacher while in the class room. Of course, he picked up more or less from his classmates during recitations, in which they spoke of kindred topics:

The Fertilization of the Trumpet-Creeper, by George Sprang.—In the bud the calyx of the Trumpet-Creeper is valvate and encloses the other

organs of the flower; the corolla is deeply imbricated, and covers the stamens and pistil.

The anthers of the young flower are very large and of a bright yellow; they are composed of two mealy sacks which are slightly attached together and fall back and nearly cover the filament.

As the flower grows and becomes larger, the anthers become smaller until they are only about one-third of their original size.

In the bud the pistil is already quite tall and has to take a stooping position, but when the flower grows and opens the pistil takes an upright position and always keeps above and out of the reach of the stamens.

Most flowers require crossing, and the arrangement of most of them is such as to prevent self-fertilization and to insure crossing.

The above example is the most common mode by which self-fertilization is prevented, but this plant has other and more striking illustrations of this fact.

The stigma is two-lobed and is so sensitive that if anything touches it, it immediately closes, hence, when the Humming-bird, the principal means by which this plant is fertilized, hovers over the flower and sticks its long proboscis down into the tube its head touches these lobes and they close almost immediately and remain so for a short time.

The anther cells are now open and ready to shed pollen, and as the bird puts its head further down into the tube, it hits these cells and the pollen is dusted upon it, and flying back it hits the pistil again but the stigma is closed and none of the pollen can get in.

But when it goes into the next flower the stigma is open and the pollen is shed upon its lips, sometimes so much as to be plainly seen by the naked eye.

This process is repeated till the bird, tired of the meagre amount of honey it gets for is labors, flies to some other plant hoping for better success.

This plant has an enemy in the black ant which does not enter the flower at the mouth, but eats through the calyx and corolla and sucks the honey which is laid up for the attraction of the birds. Even if the ant did enter at the top and get pollen upon it, it would immediately fall off from its smooth body and legs and thus use up the pollen which would be of no use to the plant in its fertilization.

But the plant's bright and gaudy corolla attracts the birds and even if one does not enter more than two or three flowers, yet it enters enough to scatter the pollen on some pistil and fertilize it.

It has often seemed to me that scientific magazines did not pay enough attention to the best modes of teaching science.

PROF. W. J. BEAL,
Agricultural College, Lansing, Mich.

Quercus heterophylla, Michx.—This tree which for so many years was comparatively unknown, now has its history very well written, yet the number of trees known are very few, and their scarcity has prevented the examination of the wood heretofore, perhaps entirely. The appointment of Prof. Sargent on the department of Forestry in the Census Bureau, has led to the examination of all the species of forest trees in the United States that could be procured. For this purpose I secured a tree of this species, found growing near Mount Holly, Burlington Co., New Jersey, and forwarded to him such portions as he desired; there yet remain in my possession several sections, which I have thought might be desirable for museums and private collections, where specimens of our native woods are kept. I will forward to each as may apply a specimen of this Bartram Oak upon being informed of the dimensions desired.—ISAAC C. MARTINDALE, *Camden, N. J.*

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